Report on the late outbreak of enteric fever in Archdeacon Johnson's School, Uppingham, Rutland, June- November, 1875.

REPORT

ON

THE LATE OUTBREAK OF ENTERIC FEVER

IN

ARCHDEACON JOHNSON'S SCHOOL, UPPINGHAM, RUTLAND,

JUNE—NOVEMBER, 1875.

MR. HAVILAND'S REPORT TO THE RURAL SANITARY AUTHORITY OF UPPINGHAM, ON THE LATE OUTBREAK OF ENTERIC FEVER IN ARCHDEACON JOHNSON'S SCHOOL, UPPINGHAM, RUTLAND, JUNE—NOVEMBER, 1875.

To the Chairman and Members of the Rural Sanitary Authority of Uppingham.

GENTLEMEN,

On the 15th October, 1875, I visited Uppingham, in accordance with your instructions, for the purpose of investigating an outbreak of Fever, which had been prevailing in the above School for some weeks previously, but which had not been reported to you until Wednesday, the 13th of October, during one of your usual weekly meetings.

On the fact that your Authority's aid was not sought by the school authorities until thirty scholars and others had been attacked by the Fever, and one of the cases was expected hourly to terminate fatally, I shall make no comment: I shall, however, ask your permission to give a detailed account of the history of this outbreak, in order that you may be enabled to understand the reason why it assumed such extensive proportions, and was attended by such fatal consequences as you have seen.

THE DISEASE.

On my arrival I immediately proceeded to the house of the Rev. R. J. Hodgkinson, M.A., Master of the Lower School, where I saw several cases, which presented the well-marked typical characters of *Enteric Fever*. This Fever is in most instances an *Endemic* disease, and has been generally known under the name of Typhoid Fever. The misleading term "Gastric" has also been applied to it, but it has long been discarded by all who have a real knowledge of its anatomical character and true nature.

The poison which produces this Fever is generated during the putrefactive fermentation of fœcal matter; especially of that voided by feeders on animal and other highly nitrogenous food, amongst whom must be classed man; also the domestic pig, when fed on the offal and blood from the butcher's slaughter-house.

Enteric Fever, although an eminently infectious disease, is not so in the same manner as Typhus Fever, Small Pox, or Scarlet Fever; the poison is not given off from the surface of the body: it is generated in the excreta of an affected person, after they are voided, during the process of putrefactive fermentation, which they invariably undergo especially when massed in cesspits, &c. This poison once formed enjoys great vitality, so that excreta containing it may almost at any time give rise to its characteristic Fever, unless they have been thoroughly disinfected by some chemical agent immediately they are discharged from the body and before they are thrown into any closet, privy, &c.—the best agents for this all important process are Copperas, or Sulphate of Iron (Green Vitriol), Carbolic Acid, Chloride of Lime, or Burnett's Fluid, which owes its efficacy to Chloride of Zinc. All these agents arrest the fermentation of the fœcal matter.

If this or some other mode of arresting fœcal fermentation, or better still of destroying the poison be not carried out, the poison is liable to gain access either to the Air or the Water in its immediate neighbourhood, and, should it do so, its power too frequently defies control until much irremediable mischief has been done. It is now held by the highest authorities, amongst whom I may mention Dr. Murchison, that the poison causing Enteric Fever may be generated during fœcal fermentation without the interposition of the excreta from an affected person, and I may add that my own experience corroborates this opinion. It becomes, therefore, of the highest importance that the cause of any *first* case occurring in a household should at once be investigated, as if it be allowed to remain undiscovered, it will in all probability prove a persistent source of fresh cases, whilst subjects capable of contracting the disease, remain within its reach. In fact, the primary cause of the first case may, and often does, induce Enteric Fever in the remaining inmates without the assistance of the poison from the diseased case. When, however, a first case has appeared there can be no difficulty in understanding how greatly the danger to the household is intensified, and how imperative the duty of the medical adviser becomes, not only to search for the cause of so preventable, but so fearful a disease as Enteric Fever, but at once to acquaint those who employ him of its true nature and of the dire necessity of rooting out at once its cause.

Not only must the medical adviser firmly perform this duty, but every other that the peculiar circumstances of the outbreak and of the family may impose upon him, for instance, whilst the nuisances are being removed, the same eminent authority, whom I have already named, states that "it will be often advisable that all the inmates below thirty years of age should absent themselves from the infected house."

THE HISTORY OF THE OUTBREAK.

The first case of Enteric Fever which I find recorded as occurring in the Rev. R. J. Hodgkinson's house, was that of a boy in the Lower School, aged nine years, B. E. H. His death was registered on the 28th June, 1875, as having occurred on the 24th of the same month, of "Enteric Fever (about 10 days), certified by Thomas Bell, L.R.C.P." This young gentleman was to all seeming in perfect health when he went to school on the 5th April, 1875. The first intimation to his parents of anything being amiss was from the poor boy himself, in a letter home on the 7th June, when he said *his throat was very sore*. Immediately on receipt of this, Mrs. Hodgkinson was written to, and her attention called to it. She was requested to see the boy at once, as although it might only be a cold, it *might yet be the beginning of fever*. She wrote to say the boy's throat was only a little relaxed, would soon be right, and that he was playing with the other boys. This set the parents' minds at ease, and no further word was heard until Thursday, the 17th June, when Mr. Hodgkinson wrote stating that the boy was poorly, and his stomach out of order, but anticipating nothing serious.

On the 19th June Mr. Hodgkinson again wrote, stating gastric symptoms had set in. At this time the father was very ill in London, and required his wife's close attendance; she, however, on Monday the 21st, went direct to Uppingham to see her son, and at once saw how very grave a case it was. She immediately telegraphed for Dr. Paley, of Peterborough. The poor boy rallied a little on the Wednesday, but suddenly collapsed and died the next day at about 8 p.m. (24th June). This was the day after the breaking up of the school for the Midsummer holidays.

I have given a short history of this case, as the course pursued by those in charge of this boy was similar to what was so complained of by the parents of other scholars whose cases terminated fatally.

After making every inquiry, I could not ascertain that any attempt was made to find out the cause of this case, and certain it is that it was not discovered until the 15th October, or if suspected or discovered, was yet allowed to remain to perform its deadly work unchecked either by the hand of common sense or of science. It must be remembered that the school had just broken up for the Midsummer holidays when this first death took place, so that there was every opportunity of doing, during the boys' absence, what your Sanitary Authority have lately compelled the authorities of the school to do.

After the reassembling of the school, the Master of the Lower School, in whose house B. E. H. died, was himself taken ill, and remained so for several weeks. This occurred about the middle of August.

On the 2nd of September, Mr. Chapman, a plumber, of Uppingham, was called in to remedy an obstruction in the flow of the sewage from the boys' trough closets into an unventilated cesspit (No. 1 on the plan). The corner of the chamber in which the obstruction was supposed to exist being dark, a lighted candle was used, and almost immediately after it had been lowered on a level with the junction where an opening had been made, a tremendous explosion took place, the sewer gases igniting, passing up to the ceiling like a streak of lightning, and at the same time burning the whiskers, eyebrows, and hair of Mr. Chapman. Of this fact I was informed on the occasion of my first visit to Mr. Hodgkinson's house, on the 15th October, whilst searching for the sources of sewer-gas in it.

Three weeks after this explosion, on the 21st September, A. K., æt. 13, fell ill of Enteric Fever. I saw this boy on the 15th October, when I was informed by Mr. Bell that he had presented the characteristic features of this disease.

On the 28th September another boy, H. Major, was attacked. This was a serious case, and he was subsequently removed, with his brother who fell about the second week in October, to London in an invalid carriage, by their father, a physician.

On the 1st October, B. Major, æt. 11, fell, and about the 2nd, I, æt. 11. From this date until the 15th nine other boys were attacked, making in all fourteen cases in Mr. Hodgkinson's house.

About the 6th of October F. E. R., æt. 12, fell. This was a serious case from the first, and terminated fatally on the 17th October. Certified "Typhoid Fever, 12 to 14 days. Thomas Bell, L.R.C.P." On the 15th October I saw this poor boy, and on that occasion I was appealed to by his mother and begged to express an opinion upon the fact that she had been kept in ignorance of the true state of her son's case until it was too late. I believe that when this poor lady arrived at her son's bedside he was too ill to recognise her, although she had hurried to him directly she knew of his illness. This lamentable case made a deep impression on me, and made me at once institute enquiries as to the grounds of her complaint. I found, indeed, that she had reason to complain, and moreover I made the further discovery that she did not stand alone in her unmerited trouble. The first case I have given, that of B. E. H., is sufficient to prove this, although there are others in the same category.

On the 6th October, Wednesday, the first case was removed from Mr. Hodgkinson's into the Sanatorium, which I shall hereafter designate as the Hospital; the term Sanatorium being utterly inapplicable to this building, as I shall show in the sequel. On the 9th, Friday, three more cases were admitted: all recovered.

Before following the spread of this Fever into the other Master's houses, I will state that there occurred in this house no less than 27 cases of Enteric Fever: viz., 18 scholars, 1 son, 2 nurses, and 6 servants, one of the last dying in the house after the establishment had been broken up. To this case I shall refer in chronological order. On the Plan Mr. Hodgkinson's house is marked B.

On the 1st of October the disease appeared in the family of the Rev. G. H. Mullins, M.A., one of the Assistant Masters. The house is marked D. The first case was that of this gentleman's son, G. H. M., æt. 4½ years. He fell on the 1st October, and died on the 14th of the same month, the day after the outbreak of the Fever was first reported to your Sanitary Authority. Between this date and the 15th nine other persons were attacked in this house:

E. W. M.,	æt.	16,	on the	3rd October
E. J. M. W.	,,	16	,,	4th ,,
E. J. S.	,,	15	,,	6th ,,
E. M. S.	,,	15	,,	6th ,,
C. E. (female)	,,	25	,,	8th ,,
P. K.	,,	15	,,	8th ,,
C. J. P.	,,	15	,,	9th ,,
W. S. H.	,,	13	,,	11th ,,
G. C.	,,	15	,,	13th ,,

E. W. M. was admitted into the hospital on the 4th October, E. J. M. W. on the 4th, E. J. S. on the 4th, P. K. on the 4th, E. M. S. on the 9th, C. J. P. on the 9th. All these cases recovered. They each remained in the hospital respectively 31, 25, 48, 24, 28, and 35 days. There were in all seventeen cases in this house, viz., thirteen scholars, two children, and two servants; five of the boys were attacked, however, after they had returned home.

On the 2nd October, S. P. N., minor, æt. 14, was attacked by Fever at the Rev. G. Christian's house (M) on the London Road, a house quite disconnected from both the town and the other school-houses, and about a quarter of a mile from the former, on the top of a hill. This boy came to school on the 12th August, on the 2nd October he was seized with faintness whilst at singing practice. Mr. Bell saw him the same evening and again on the next day, Sunday. N. was in the habit of going to the infected houses (E) and (F), Mr. Campbell's and Mr. Williams's, and he had a friend at Mr. Mullins's (D), with whom he was constantly. He was removed to the Hospital on the Monday following, and died there on the 21st October, the cause being certified thus: "Typhoid Fever, 23 or 24 days.—Thomas Bell, L.R.C.P."

This was the only case in this Assistant-Master's house.

On the 1st October the Fever appeared in the Rev. W. Campbell's house (E). Two of his children, the Matron, and one boy were attacked; two others fell subsequently. The first cases were attacked simultaneously, or nearly so. They had complained of a bad smell in the yard, which had been attributed to the Rev. Mr. Williams's ventilator. It was, however, discovered subsequently that the cause of the smell in the Matron's room was a broken rain-water-pipe, which acted as a ventilator to the cesspool. This pipe ran up the side of the house, and was broken completely under the ivy, about three feet from the ground. The fracture was gaping, and involved the entire circumference of the pipe.

The boy D., æt. 15, was removed to the Hospital on the 5th October, and left it on the 27th.

On the 12th October, the day before your Sanitary Authority were made acquainted with this outbreak, there were twelve boys lying stricken with Enteric Fever in the School Hospital, viz, *four* from the Rev. R. J. Hodgkinson's, *six* from the Rev. G. H. Mullins's, *one* from the Rev. W. Campbell's, and *one* from the Rev. G. Christian's.

At the same date there were lying ill of the same disease at different houses belonging to the school 18 other persons; making a total of 30 cases, which may be arranged chronologically thus:—

In the week between the 21st September and the 28th September *two* cases occurred; between 28th September and 5th October *twelve* cases, and between 5th October and 12th October *sixteen* cases.

Up to this time I cannot ascertain that a single step had been taken towards investigating the cause of this lamentable outbreak, nor one active measure carried out to mitigate the evil or to prevent its extension. The school was still carried on, and no orders issued that the sound scholars should not visit the infected houses. From the above weekly figures it is evident that the disease was rapidly gaining ground and threatening to involve the whole school.

At this critical juncture, on Wednesday the 13th of October, at one of your ordinary

weekly meetings, the fact was officially reported to you that *"there were some cases of fever in the School."*

At 2.10 p.m. your Inspector, after a visit in accordance with your orders, sent me a telegram to the following effect:—"Fever in the School Houses here; your immediate attendance is requested; a committee will be summoned to meet you; reply by telegram."

At the time that this message reached Northampton I was from home, and did not return till the following (Thursday) evening, too late for the last train to Seaton. I, however, immediately telegraphed a reply to say that I would start for Uppingham by the first train the next morning. This I did, and commenced my enquiry soon after 11 a.m. on Friday, the 15th October.

With your telegram I also received two letters, one from the Rev. Edward Thring, M.A., Head Master of the School, and the other from the Rev. G. M. Mullins, M.A., one of the Assistant-Masters. Both letters were dated Uppingham, October 11th, 1875, and both had the 11th Oct. as the date of the Uppingham post-mark, and both had the 12th October as the date of the Northampton post-mark. I note this as there are two posts despatched from Uppingham, one in the forenoon and the other at 7.30 p.m.

Before proceeding with the history, I must go back a few days, in order that your authority should understand what had been done previously to the Masters reporting the existence of Fever in the school-houses.

On Saturday, the 16th, I again visited Uppingham, and my suspicions having been aroused by the painful scene I had witnessed the day before at the Rev. Mr. Hodgkinson's, that the true nature and extent of the disease had been withheld from the parents and guardians of the boys, as well as from your Authority, I made especial enquiries on this point, and elicited from a gentleman deeply interested in the welfare of one of the boys some of the following facts, to which I have added others culled from various sources of the most trustworthy character.

Soon after arriving at Uppingham, on Saturday the 16th, I was informed that a meeting of some of the parents and guardians at Liverpool, who had boys at the school, was held in that town on Monday the 11th of October, when it was decided to send a telegram to Mr. Thring to the following effect:—"That those present intended to petition the Local Government Board to send an Inspector to Uppingham, and wished to know whether they could do so with his sanction." This telegram was despatched from Liverpool at 12 noon; but the reply from Mr. Thring only arrived at 5 p.m. of the same day (the 11th). It ran thus:—"Mr. Mullins has already sent to Dr. Hasland, of Leicester, our county authority, to come and inspect and report under *my sanction. The Liverpool parents must not take action.*" The errors, Hasland for Haviland, and Leicester for Northampton, were afterwards corrected.

On the same day (Monday the 11th October) Mr. Thring wrote me a letter, whether before or after receiving the Liverpool telegram I am unable to say; the post-marks, however, at Uppingham and Northampton, one being dated the 11th and the other the 12th October, would lead me to infer that his and Mr. Mullins's letter were both

despatched by the evening instead of by the morning mail; and therefore *after* the telegram had been received. Mr. Thring's letter was as follows:

"The School-house, Uppingham, Rutland,
"Oct. 11, 1875.

"DEAR SIR,

"The town has for some time had sundry cases of fever. This last week there has been an outbreak of fever, called by some low fever, by others typhoid, and by the most eminent man, I believe, who has delivered an opinion on it—Dr. Hastings, a London physician, whose son is here—gastritis. This fever, whatever its name, has fallen heavily in quantity, and with some danger, on two of our houses, and there have been single cases in two other houses.

"It is very important to us to correct any evil, if it exists, and to be above suspicion, if it does not. I should be greatly obliged if you could come over without delay, and test and examine the drain system of these houses and their water supply, as well as the school-houses generally, and anything likely to be of use in putting things on the best footing. If you cannot come yourself, perhaps you would kindly telegraph to me, as it is no use to us to have the inspection of any man whose name will not carry respect and conviction, not only in this immediate neighbourhood, but also in other parts of England, amongst the parents of the boys in the great towns especially. I trust you will be able to accede to this request.

"Believe me, yours truly,
"EDWARD THRING.

"A. Haviland, Esq."

The dates of the post-marks on this letter were—Kettering, 12th, Oct.; Rothwell, 12th October; Northampton, 12th October.

The letter from Mr. Mullins was of the same date. In it he said, "I make formal application to you, as the Medical Officer to the Uppingham Sanitary Board, to investigate into the true nature and cause of an outbreak of Typhoid Fever (so called by Mr. Bell) which has occurred in my own house." He then goes on to state that he believed his drainage to be in every respect good and sound; that he used the water from the "Town Spring," which he believed to be pure. He also stated that he had seven pupils and two servants attacked by it (the fever). With regard to the town, he says: "I may mention that there are several similar cases in other houses in the town." In conclusion, he adds, "In saying Typhoid Fever (so called by Mr. Bell), I do not mean to impugn his opinion, but to justify my using the words, as other authorities deny that the illness is Typhoid Fever." This letter had two post-marks viz., "Uppingham, Oct. 11," and "Northampton Oct. 12." Both these letters I received on my return home on Thursday evening, the 14th October, at the same time that I received your telegrams.

On the 10th of October, Mr. Thring wrote to one of the trustees, stating that 'the school had nothing to fear,' and on the same day arranged that Mr. Mullins should intimate the facts to the parents of the boys. At this date it could not be ascertained that any attempt had been made to find out the cause of the outbreak.

On the 15th October (Friday) I arrived at Uppingham, and at once proceeded to attend the special meeting of your Sanitary Committee. Mr. Thring and some of the masters were present. I briefly explained the course that I intended to follow in the enquiry, and promised to meet the Masters at 4 p.m. at the Rev. T. B. Rowe's. Your Chairman at this meeting expressed his determination that a thorough and

searching investigation should be made as to the cause of the outbreak in the school, and the Head-Master expressed his gratification at this resolve.

At 4 p.m. I met the Masters after I had visited Mr. Hodgkinson's and some other houses. I explained to them the nature of the disease, and its probable origin. I declined, however, at that early stage to say more on the subject of dismissing the school, than 'that I did not feel myself justified at that moment in recommending the breaking up of the establishments of Masters whose houses were not infected.' I understand that Mr. Thring telegraphed to Liverpool to this effect: 'Haviland gives his judgment the school may go on with safety, and need not be dispersed."

On the 16th October I returned to Uppingham, and, having satisfied myself of the cause of the outbreak in Mr. Hodgkinson's house, I proceeded to make enquiries into the milk supply of the school, which I found to be of an unexceptional character: Mr. Wortley, of Ridlington, was the purveyor generally to nearly all the school-houses, and especially to those infected.

In consequence of the first paragraph in Mr. Thring's letter of the 11th October, I at once proceeded to enquire into the cases of Fever occurring or which had occurred in the town, and requested the inspector to ask the medical gentlemen of the town to meet me on the occasion of my next visit to Uppingham—the senior gentleman to be consulted first as to the most appropriate time and place. I examined the Infant National School, when I found the privies in a most disgraceful state, they were in the act of emptying them, earth was used saturated with former emptyings; this was supposed to be on the 'dry' earth system. I have called attention to the state of these privies some time previously when an outbreak of Scarlet Fever took place among the pupils, but the school mistress and those connected with the management seem to have paid little heed to my instructions, *en passant*, I must beg your Authority to enjoin your Inspector to keep a strict surveillance over this establishment. I visited the Hospital. I also instituted enquiry with regard to the public water supply, the results of which will be seen in the sequel.

I continued my inspection of the infected houses. On the 17th October I wrote to the Inspector stating when I should again be in Uppingham, and in reply I received a letter from him dated the 19th, in which he wrote "I have attended to your request contained in your letter of the 17th, and have to-day seen the three medical gentlemen here, and arranged with them to meet you at the Falcon Hotel, on Thursday morning at 9.45 a.m." He also informed me that he had obtained samples of water for me from the Masters' houses, which I examined on the occasion of my next visit. Mr. Thring, he understood, had sent some samples to Professor Wanklyn.

On Wednesday, 20th October, I attended your Sanitary Board, when it was reported that the Rev. Mr. Hodgkinson had discharged and sent home his cook ill with Fever to Caldecott, this afterwards proved to be correct, and I have already reported on the facts of this case, which however I shall again allude to, as it happened that the girl's next door neighbour, a youth called Stanger, æt. 18, was seized with Fever shortly after her arrival home, and died—the excreta of the girl were thrown into the same privy as that used by the lad.

On this day also I proposed to you flushing and disinfecting the sewers, but found that you had no means of doing so.

I continued my inspection of the school houses.

On Thursday, 21st October, in consequence of the serious illness of Mr. Walford,

this gentleman sent a message to the effect that he would feel much obliged if I would arrange to meet the other medical gentlemen at his house instead of at the Falcon Hotel; to this of course I immediately acceded, and wrote a note to Mr. Bell informing him of the reason of the change of place of meeting, and asking him to meet us at Mr. Walford's. He sent a verbal but equivocal reply, so that I was in doubt whether he intended to be present or not. He did not attend, and sent no reason for his absence, either verbally or by letter. I met Mr. Bell after the meeting and shook hands with him, but he made no allusion to his absence; since then I have never met him so as to be able to have any conversation with him.

At the meeting at Mr. Walford's there was Mr. Frederick Brown and myself (there are only three medical practitioners in Uppingham and immediate neighbourhood). On my enquiring as to the existence of Enteric (Typhoid) Fever in the town of Uppingham, Mr. Brown informed me that he had no cases then, and had not had any for *two years*, and Mr. Walford also stated that he only had three cases, and these were all in one house, within the walls of which were contained a sufficient number of local causes to produce Fever anywhere. I subsequently visited this house, and the result of my investigations fully bore out Mr. Walford's opinion. This case was that of Mr. Baines, who subsequently died. This being the case, I was obliged to infer that, if Mr. Thring's statement, with which he commenced his letter, were true, "that the town has for some time had sundry cases of Fever," Mr. Bell must have them all under his care except the three cases in one house just mentioned. Mr. Bell's absence, therefore, on this account was greatly to be regretted, as it seemed alone in his power to verify the assertion of Mr. Thring. The want of information from Mr. Bell on this point, of course, rendered it necessary for me to obtain it how I could. Every facility was offered me by Messrs. Walford and Brown, who throughout this anxious enquiry rendered me every assistance within their power, and I beg to tender them my best thanks for the valuable service they *rendered* me. At this date the only case reported to me as "Typhoid," and not belonging to the two gentlemen just named, was that of Hudson's daughter, near to the toll bar. This, from the evidence of the girl's mother, appeared to have been a case of Enteric Fever; but this was the only one out of the many reported, that bore the slightest resemblance to the disease, the others were ailments of different character—bad cold, rheumatism, &c. In Hudson's case I found the cesspool under the roof of the cottage, and above the level of the wall, which was only four feet from it. The cottage is close to a main sewer, so that the cesspit has no reason for existence. This, I would recommend, your Authority to do away with at once.

I am informed on good authority, that absence from Uppingham on professional business was not the cause of Mr. Bell's non-attendance. Had Mr. Thring's statement been true and the "sundry cases" capable of being proved to be undoubted Typhoid Fever, he would have ordered his medical adviser to attend our meeting. At this date (21st October, 1875), therefore, I note that I had *direct* evidence of only *three* cases of Enteric Fever existing in the town of Uppingham, and indirect evidence that a case occurred near the toll bar, at the farthest possible distance from where the school outbreak commenced, on the 26th August, under circumstances above mentioned. I had no evidence on which to rely, that there was a single other case of Enteric Fever outside the school houses.

After the meeting I proceeded during the remainder of the day with my inspection of the Master's houses.

Just as I was starting by train from Seaton I heard that, although the house scholars had left Mr. Hodgkinson's and Mr. Mullins's houses at this date (21st October), that

these and other infected houses had *not* been practically closed for school purposes, that boys were not only kept in them, but that others were sent to these houses to take their lessons. On my way to Northampton I telegraphed from Market Harborough to the Inspector to immediately call upon Mr. Thring and tell him that this practice must be stopped at once, and the resident boys leave. On the 22nd October the Inspector wrote as follows:—"Immediately I received your telegram this morning I called at Mr. Thring's house with it, and as I found I should be unable to see him for more than an hour; I left, promising to call upon him again when I returned from Caldecott, where I have been to make enquiries as to the maid servant sent home by Mrs. Hodgkinson. I have seen Mr. Thring this morning, who states, "The whole of the boys have left Mr. Hodgkinson's and Mr. Mullins's houses, but that he cannot break up Mr. Campbell's and Mr. Christian's houses without knowing there is any authority to compel him to do so; and considering the great interests at stake, he should not feel justified in doing it, even if there is any law to compel him to do so, without first consulting the parents of the boys. He does not think Mr. Christian's can be considered an infected house, as it is about three weeks since Nash was removed from it. (This poor boy, I find, was removed to the Hospital on the 4th October, and died on the 21st.)

On Tuesday, the 26th October, I again visited Uppingham, and continued the inspection of the Masters' houses, and was much struck with the want of cubical space and ventilation of the boys' studies, &c. I determined to make enquiries into this matter, and shall give the results in the sequel.

On Wednesday, the 27th, I attended the usual weekly meeting of your Authority, and read a preliminary report, which contained recommendations to your Authority to serve notices immediately on the Rev. R. J. Hodgkinson, Master of the lower school; the Rev. W. Campbell, M.A., Assistant-Master; the Rev. G. H. Mullins, M.A., Assistant Master; and the Rev. W. J. Earle, M.A., Usher and Sub-Warden, to remove nuisances from their cesspits and other sources of nuisances detrimental to health. Your Authority immediately ordered the clerk to carry out my recommendations, and the notices were promptly served.

At this meeting the case of Mary Elizabeth Smith, of Caldecott, late cook to the Rev. R. Hodgkinson, was discussed with the view of taking proceedings for allowing his servant to expose herself whilst suffering from an infectious disease. Your Authority requested me to visit the girl at her residence, which I did on the same day, and reported to you the result of my enquiry on the 31st October.

On Thursday, the 28th, finding that the sound boys were still allowed to go to the infected houses, I wrote again to the Inspector, Mr. Frederick James, and inclosed two notes, one to the Head Master and Warden, and another to the Usher and Sub-Warden, both of which were to the following effect:—That the practice of the boys going to the infected houses must be suspended for the present, and that it was absolutely necessary that all communications between those houses and the school should cease. The houses to which I referred were Messrs. Hodgkinson, Mullins, and Campbell. These I named to both gentlemen.

I received no reply to either of these letters, but my anxiety was much relieved by the fact that the day after (Friday, 29th October) the receipt of my letters by Mr. Thring

and Mr. Earle, a meeting of the School Trustees took place, when it was decided to dismiss the School, and that the boys should return home on the Tuesday following.

From enquiries made I could not ascertain that any medical examination took place of the scholars before their departure for home. I had already inferred this from the fact that several boys were attacked by Enteric Fever after arrival at their several destinations, some within so short a period as to induce me to believe that they were actually suffering from Fever at the time of their leaving the School.

On Monday, 1st November, I received a copy of Mr. Thring's manifesto or circular to parents, guardians, and others. It was simply dated "Oct., 1875," and signed "Edward Thring, Head-Master." Where it was written, or during what period of the month so eventful in the history of the Uppingham School, I cannot ascertain from any internal evidence. I shall again refer to the document.

On Tuesday, 2nd November, the boys went home.

On the 2nd of November, having satisfied myself of the causes of the outbreak of the Fever, but still hearing that the Masters, with all the glaring facts before them which have been given by me and detailed by your Engineer, still were of opinion that the Town Drainage was the cause, I consulted Mr. Rogers Field, C.E., privately, as I wished to be advised as to the general drainage of the town, being anxious that nothing should be left undone. Your Chairman, you will remember, from the first, thought it desirable that some eminent Engineer should be employed, and your Committee at once decided upon taking this necessary and most important step, and appointed the gentleman who will report to you.

From the moment that the boys left, the subject of their return was uppermost in the minds of the schoolmasters and others, and various days have been named for the reopening of the school. One of these days was the 1st or 3rd of January.

As circulars were sent from time to time to parents intimating that a Local Government Board Commission was being held, and that all things should be carried out in accordance with the Commissioners' instructions, I was constantly appealed to by parents as to when it was likely that the school could be opened with safety. I invariably replied that it necessarily would be a long time before the infected houses could be fit to receive boys, and that until I felt convinced that all things had been done to secure their safety, I should not advise your Sanitary Authority to sanction a premature return of the scholars; and on one occasion, when I was informed that it was intended to call the boys together without any guarantee from your Authority that they could do so with safety, I urged you, in conjunction with Mr. Rogers Field, to withhold your sanction, and not "in any way countenance the premature return of the scholars until we could report to you that each individual house in connection with the school is in a perfect sanitary condition."

This *ad interim* report we felt bound to send to you even at so early a date as December 4th, 1875. It was ordered to be published in the *Times* and *Lancet*.

On the 22nd December I received a letter from the Local Government Board enclosing a copy of some complaints made by Mr. Thomas Bell, of Uppingham, as to

the mode of my conducting this investigation. The extract forwarded to me by the assistant secretary I now subjoin in full.

"I will now pass to some complaints I have to make against Mr. Haviland, and I append to this a copy of a letter I addressed to him on the subject. He has not replied to my letter, and I should have let the matter drop, but that he continues his visits to my patients without acquainting me of his intentions, or consulting me in any way.

As I have stated earlier, I gave every information Mr. Haviland required; but as I did not attend his meetings he has taken offence, I suppose, and has not asked for any information from me since, but picks it up where he can, and then goes and visits my patients. This course is, in my opinion, most unprofessional, and not what I should have expected from any gentleman.

It appears to me a lamentable waste of his time to be visiting patients, when it would have expedited matters considerably if he had confined himself to the investigation of the causes. He is told what the cases are, and I suppose a private practitioner is quite as able to form an opinion as a Medical Officer of Health. I believed he had nothing to do with the cases, or the number of cases; if he is told there are 10 cases within a given area, that is as good for him as a 1,000. There is a cause at work somewhere, and with that cause I suppose he has to deal. One patient of mine he visited on the 30th ultimo, a married woman within some six weeks of her confinement, and now convalescing. He must needs enquire when she expected her confinement. How she calculated the time and other questions equally irrelevant; I should very much like to know what all this had to do with the cause of her illness, and whether it is suitable conduct for a Medical Officer of Health to pursue. I may say he walked into the cottage, and straight upstairs, without enquiring whether he might do so, or whether she was in a fit state to receive him. He had visited this patient on the 25th ult., so what he wanted there again I am at a loss to understand. On the 25th she was very poorly, and his visit upset her very much at the time. The nurse in charge tried to prevent his going upstairs, but he insisted on doing so.

I find with other medical men here he can ask if he may visit their patients, and go with them to do so; I think the same courtesy ought to be extended to myself.

If the Sanitary Authority here had not supported Mr. Haviland in his attack upon me, I should not have troubled you with this correspondence, but should have asked them to use their authority to prevent the conduct of which I complain. He began the attack, and I must defend myself.

Sanitary science cannot be advanced by such conduct: it is necessary for that to work harmoniously together, and I consider it incumbent on your honorable Board to enforce such regulations as you may have framed for the conduct of the Medical Officers of Health, so as to promote a willing co-operation and restrain the Medical Officers of Health from being guilty of the conduct of which I complain.

I append the three more important questions referred to in my letter to Mr. Haviland, and also some that have been suggested by his later conduct, and shall be much obliged by your replying to them according to your code of regulations laid down for Medical Officers of Health, at the same time that you send me your remarks upon the various statements in my letter, which I hope to receive by an early post.

The importance of the subject is my apology for having to trouble you with so long a letter, and your position entitles me to your protection from annoyances caused by your own subordinate."

On the 24th November I received the following telegram from the Sanitary Authority: "Sanitary Authority wish you to come here early to-morrow—early as possible—fresh cases of Fever top end of the town."

On the next day (25th) I went to Uppingham, and went at once to the houses in which the persons attacked were living. One was the woman mentioned in the "Extract." I was introduced upstairs by a "sister," who had been engaged to nurse her. The poor woman was much depressed and weeping. In order to ascertain whether she was really suffering from Fever, I put a few questions to her, and then, as she was anxious about her approaching confinement, I made the necessary enquiries as to the time when she expected to be confined. My questions were prompted by a desire to give her what consolation I could in her trouble, and to do this honestly I felt bound to make myself acquainted with certain facts relative to her peculiar

condition; having done so, I was pleased to be able to give her a favourable opinion, and cheered her by assuring her that she had every prospect of getting through her troubles without danger. I am glad to think that I was not in error. At the time of my visit I did not know whose patient she was; but had the impression that she was under Dr. Brown.

On the occasion of my next visit, I simply asked for the "sister," but she was gone. I was anxious to clear up a doubt as to the connection of the attack with the cases in the Hospital. On this occasion I simply asked her one or two questions as to her family, and, finding her better, congratulated her, and left her to investigate some of the matters complained of by herself and neighbours.

As to the letter and questions enclosed, which Mr. Bell referred to, all I can say is that he threatened that he should send the questions to the *Lancet* for replies. Under these circumstances I certainly did not feel called upon to reply to them myself. He did send these questions to the *Lancet*, and got them well answered (Nov. 13th, 1875).

Whilst on this subject, I will state a fact of which, perhaps, he is not aware, as he has not complained of it to the Local Government Board. During one of my visits to the Hospital I was appealed to by the matron, who stated that she was in great trouble in consequence of Mr. Bell having given sanction to the removal of one of the convalescent patients (just able to get up) back into the pestilential atmosphere of Mr. Hodgkinson's, where he had contracted his disease, in order to make room for another boy who had been lately siezed there. In this case I certainly did interfere, much to the relief of the worthy matron. This lady informed me that Mr. Thring had humanely seconded her opposition to Mr. Bell's orders.

I regret that I was not in Uppingham when the poor boy Oldham was removed in a dying state from Mr. Hodgkinson's house to the Hospital. It appears that he was suffering from Peritonitis at the time. He was admitted at 4 p.m. on the 22nd Oct., and died the next day at 7.30 p.m. This was the case that the convalescent boy above was ordered to make room for.

In the first place, I have already explained my mode of procedure at the outset of the enquiry, in order to place myself in friendly relations with my professional brethren in the town, and I have stated the facts connected with the meeting held at Mr. Walford's house. Mr. Bell withheld his support and assistance on that occasion, and never afterwards proffered me any information, either in reference to the scholars or his town patients.

The other two medical men gave me free access to their patients, and I was glad to avail myself of their kindness.

On Tuesday, the 4th January, whilst attending with Messrs. Field and Tarbotton a consultation at Mr. Rawlinson's office, that gentleman handed to me the subjoined memorial and letter. I had received a few days before a letter from Mr. Thring breathing the same spirit:

[COPY.]

"Uppingham, 3rd January, 1876.

"To R. Rawlinson, Esq.

"Sir,

"On behalf of those who have signed the enclosed memorial to the Chairman of the Sanitary Board of Uppingham Union, I beg to enclose a copy of it, in the hope that your influence may be exerted to remove the grievance of which complaint is made.

"It is signed by many of the principal inhabitants. More signatures might be obtained did time allow, but as it is thought desirable to forward the memorial by this post, time does not admit of more.

"I am, Sir, your very obedient servant,
(Signed) "JOHN HAWTHORN.

'True Copy,
"W. H. Waters,
"2, Westminster Chambers, London.'

[Copy.]

"*To the Chairman of the Sanitary Authority of the Uppingham Board of Guardians.*

"We, the undersigned Ratepayers of the parish of Uppingham, having certain knowledge that your Medical Officer of Health (Mr. Haviland) has made various unofficial statements, in respect to the Sanitary state of Uppingham, and to which, as they are made privately, and cannot be met, we object as unjust and unworthy for a responsible public officer.

"We hereby request, that in common fairness to ourselves, you will direct your Medical Officer of Health to abstain from all premature unofficial communications, and that he may be directed to confine himself in future to the reports he makes officially to your board under which he holds office, or to the superior authorities in London.

"*Uppingham, 3rd January*, 1876.

"Wm. Ingram,
Thomas Wright,
Wm. Compton,
Thos. Dean,
Thos. B. Rowe,
Wm. Hope,
B. Hopkins,
W. G. Hart,
J. C. Guy,
Thos. Dolby,
G. A. Townsend,

"Charles White,
W. Hopkins,
H. Ashwell,
H. Kirby,
Thos. Perkins,
Arthur J. Jourdan,
J. B. Mould,
Wm. Wilford
B. Freer,
Jno. Hawthorn,
Wm. Welford.

"True copy,
"W. H. Waters,
"2, Westminster Chambers, London.

CAUSES OF THE OUTBREAK OF ENTERIC FEVER IN UPPINGHAM SCHOOL.

I have said immediately on my arrival at Uppingham on the 15th October, after attending a special meeting of your Board, at which Mr. Thring and other Masters were present, I proceeded to the Rev. R. J. Hodgkinson's, the Master's house, where I was informed the first case had appeared, that of A. K., æt. 13, who was attacked on the 21st September, three weeks after the explosion of the unventilated cesspit, No. 1, mentioned in the Histories of the Outbreak.

At the time of the attack this boy was residing with the Master of the junior school, the Rev. R. J. Hodgkinson, M.A., who, some seven or eight years ago, had built, by Messrs. architects, a large and handsome mansion at a cost of about 10,000*l*. It stands on a good site of the same formation, Northampton Sand, as the town, but on a higher level; it commands a view of the valley of the stream, which rises a little above it to the north-west, skirts the southern boundary of the garden. This stream above this point is pure and limpid, and is perennial. It is subject to sudden risings after or during heavy rains, and then it becomes torrental. After passing the garden it flows along the south of the town, receiving first an affluent which may be traced to the overflow of the Town Spring (XIII). On the plan here it is contaminated by the oozings from the site of the old gas works, which on the occasion of my last visit (14 December) were plainly indicated by the *iridescence* of the water that joined the stream; after this it receives the drainings from manure heaps, of a cowshed, a pigstye, a stable, and other accumulation of filth, belonging to S. Thorpe, all which, during winter and heavy summer rains, drain into this stream through a gap cut on purpose, and before passing under the bridge it becomes still further polluted by the small overflow of a cesspit in the neighbourhood of the National School;* in fact, in a sketch map of the town, kindly supplied to me by one of the Masters, this spot is noted as "Bad drain here." After this the stream skirts the *cemetery*, and receives its *drainage;* it then flows on beyond the town, and becomes the *feeder* of the *bathing place* and *swimming pond!* There the water becomes so filthy, that from information of gentlemen who were old Uppingham boys, many wisely declined to enter its befouled waters. From the testimony of the father of one of the boys, who on the occasion of my first visit was down with Enteric Fever, I understood that "the water was often in a most foul condition, especially after rain."

The poor boy Nash, who was attacked by Enteric Fever at the Rev. Mr. Christian's, on the 2nd of October, and died in the Hospital on the 21st of the same month, had bathed in this filthy pond as late as the 14th September, if not later.

This stream receives the drainage from Mr. Hodgkinson's garden, part of which is manured with the contents of the cesspits, Nos. 4 and 5, which between them receive the overflow of all the water-closets and privies in the house. From cesspit No. 4, liquid manure is pumped up, and the contents of No. 5 are used for his celery beds, &c., in the garden.

The house water closets, those in fact which would receive the excreta of invalid boys, all discharge into No. 4, the pit to which is attached a pump for manurial purposes.

* The National School cesspit empties itself by a nine inch drain into the mouth of the Culvert which falls into this brook.

I regard this stream as an important possible factor in the causation of disease among the Uppingham Scholars, and have on a former occasion reported to your Authority on the necessity of taking steps to prevent its pollution as a water course; under any circumstance it is unfit to be used as a feeder for the bathing place, in consequence of its receiving the drainage of the cemetery.

This brook passes to the south of Bisbrook, where I am informed it is used for brewing purposes.

In the first part of its course this stream flows on a bed of *Northampton Sand*. It may be called the South Brook, in contradistinction to the one skirting Uppingham to the north.

Returning again to the house, I was informed that the foundation was formed of the most solid material, in fact of bricks laid in concrete; a thousand pounds were expended on it before the works were commenced.

Outside the house on its western aspect were three cesspits.

No. 1 was situated at the north west angle of the house, and received the sewage of the boys' 5 trough closets A A by means of an elastic six-inch india rubber tube, which was constructed of spiral wire and canvas; this was fixed in a tight chamber, and by an arrangement of levers was held up in a curved position, and when flushing took place was suddenly released and allowed to assume a straight position, when the sewage and flushing water passed straight into the cesspit No. 1, through a stone drain, so that the pent up gases in the cesspit could easily regurgitate into the closets whenever flushed; on one occasion alluded to in the history, an obstruction took place and when removed an explosion of inflammable gases succeeded (Sept. 2nd, 1875).

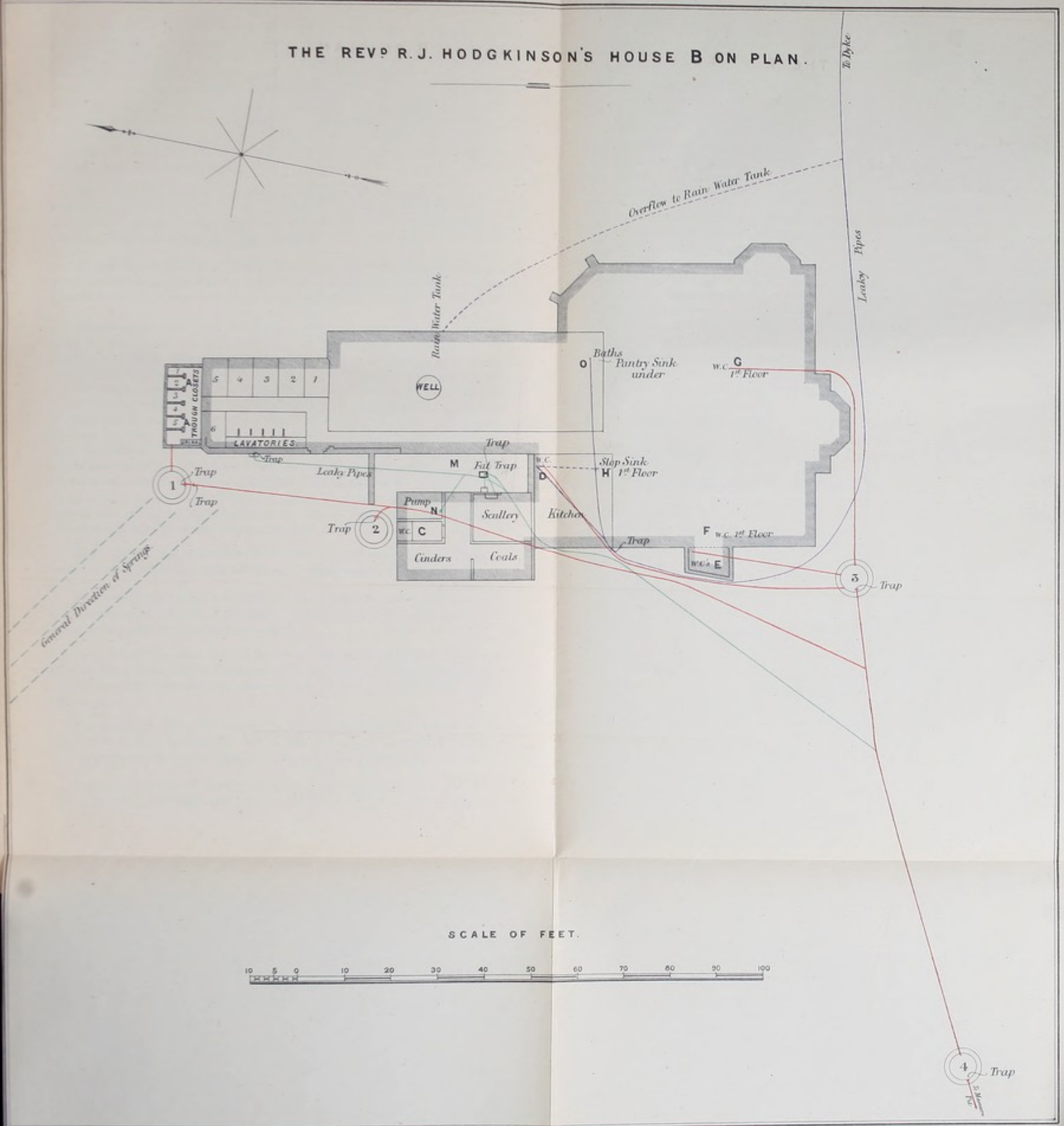
On looking at the plan you will find that these closets and their sewer-gases are in close contiguity to the boys' six studies, which open into a passage leading into the building devoted to the closets and the urinal, which also empties into cesspit No. 1.

This building is covered by a glass roof, which admits of a partial ventilation, in consequence of its not reaching the top of the closet chambers by a few inches. This source of ventilation, although it may undoubtedly dilate the sewer-gases to a certain extent and under certain conditions, as at other times during the prevalence of any winds from the N.E. to the S.W., would have the effect of propelling the sewer-gases into the study passage, studies, lavatories, dining hall, class room, and the house generally. The lavatories communicate by means of their waste pipes, which were trapped with the drain that leads from No. 3 cesspits, and which receives the overflow from the four water closets in the house, besides that from cesspits Nos. 2 and 3.

The studies therefore of the boys, and of course the five trough closets, were in close contiguity to this cesspit No. 1, which it must be remembered was totally unventilated, although it was discovered when this pit was opened that an arrangement had been made in the brickwork for carrying up a ventilating apparatus of some kind. This, however, was left undone, and I cannot ascertain whether the neglect in carrying out the original plan arose from the work being "scamped," or from alteration of the plan without due regard to the consequences.

The fact remains the same—this pit was left unventilated when constructed—and this evidently conduced to the explosion already reported, and the constant regurgitation of gases underneath the seats of the closets, and thence into the studies and house at all times.

THE REVᵈ R. J. HODGKINSON'S HOUSE B ON PLAN.



This cesspit was well constructed so far as brickwork and cement were concerned. It was about 24 feet in circumference, 8½ feet deep, and 8 feet in diameter; when uncovered it was found full to the very top with solid sewage, and the effluvium from it was beyond description. One person who had simply bent over this cesspool soon after it was opened was siezed, although in perfect health at the time, with diarrhœa, which lasted for more than a week. On the fifth day after inhalation he was seized with violent purging and vomiting which rendered medical assistance necessary. I mention this fact because it came under my own observation, and because the effects followed so soon after the exposure to the cause as to lead to no other conclusion than that the miasma from this magazine produced the effects described.

This cesspit had received the excreta of upwards of 40 boys daily, for five years, without being emptied, during the whole of which time it had acted as an enormous sewer-gas generator, sending its emanations forth whenever it had a chance through the remarkable flexible tube, which I have just described.

In describing the causes of Enteric Fever I have said that, unless the poison is destroyed or its formation prevented, it will contaminate the *air* or the *water* in its immediate neighbourhood, and that should it do so its power frequently defies control.

After satisfying myself as to the nature of the disease, I went from the dormitories direct to these closets, and after having inspected them minutely, and had them well described to me by Mr. Chapman, the plumber, I came to the conclusion that at all events I had met with one possible source of the outbreak in this house at least, if not the actual one. My later experience justified the conclusion, and I have no hesitation now in stating that I believe that the sewer-gases generated in this cesspit found their way by regurgitation into the boys' closets, and thence into the studies, lavatories, and class-rooms adjoining, and the house generally. I believe also that this state of things existed in the June previous to the late outbreak, and that the *first* case which occurred in this house, that of B. E. H., may be attributed to the influence of the sewer-gas to which he was subjected just before the 7th of that month. It must be remembered that this poor boy was allowed unwisely, during the early stage of his fatal illness, to be playing about with the other boys; and we naturally infer making use of the closets, which, up to the time of the destruction of the cesspits, had an atmosphere tainted with sewer-gases.

This being the case, the cesspits would contain his *Enteric excreta*, and therefore would have the actual poison contained within it, ready to escape at any time.

At this time it is ever to be deplored that Mr. Hodgkinson was not properly advised as to the true nature and cause of the disease which attacked this first case, and as to the proper means to take to avert any future calamity.

Your Authority is aware that the town, ever anxious to promote the welfare and interests of the school, carried the South Sewer along the Stockerstone Road to a considerable distance beyond this house and the Sanatorium, in order to enable them to be drained with it.

The cesspit (No. 1) is only between 30 and 40 yards from this sewer, which was completed on or about 1st December, 1872, so that the necessity of the cesspit system in Mr. Hodgkinson's house and the Sanatorium had ceased to exist for nearly three years.

Having convinced myself that sewer-gas of the worst description could escape from the cesspit, and actually had forced itself into the closets, I proceeded to enquire what other

inlets there were. I shall, however, leave the description of these to your Engineer, Mr. Rogers Field, whom you have instructed to draw up a report on the public and private drainage of the town.

The Water Supply of this house was derived from a well below the wine cellar; it was described to me as a reservoir into which several springs were directed; it was under the concreted foundation; it was 43 feet from cesspit No. 1, and 15 feet from No. 2; but the springs which approach the well from the N.W., in a line from the Sanatorium, pass *under* the connecting drain between cesspits Nos. 1 and 2. The cisterns of the water closets were filled from the well, and I was informed that the boys' rooms were supplied direct from the *pump*.

The water supply of this house has peculiar interest, not only in relation to the outbreak in the house itself, but to the public water supply derived from the *Town Spring*, which is the outfall of a spring that may be traced from the point at which it issues from the rock, back in a north-westerly direction, through Mr. Hodgkinson's lawn, under the entrance of his house, the drain connecting Nos. 1 and 2 cesspits as far as the Sanatorium well, when it is again found in the close neighbourhood of another cesspit. I must, however, say that I have no positive evidence that it does extend from the house to the Sanatorium, although I have every reason to believe that it does so. That it extends from the well to the outlet of the top *Town Spring* can be demonstrated at any time, for as it passes under the green-sward, it produces a stronger and quicker growth of grass above. This fact was pointed out to me by the gardener, who informed me that he was obliged to mow the grass there four times more in the course of the line which the spring pursues, than over the other parts of the grass plot. At the time of my visit I could distinctly see the line of coarser grass, the direction of which was in a north-westerly direction from the Town Spring to the most northerly of the three windows in the boys' dining hall.

I examined this water during one of my first visits, and since then it has been analysed by Professors Attfield, Frankland, and Wanklyn. On October 21st a sample was also taken from Mr. Hodgkinson's well, and examined by Dr. Anderson, of Coventry, the medical attendant of one of the boys who were attacked in Mr. Hodgkinson's house, and who subsequently attended (during a fatal attack of Enteric Fever) the nurse, who fetched his patient, but who was in the house not more than twenty-four hours. A copy of this analysis Dr. Anderson has kindly forwarded to me, and will be found in the Appendix.

This analysis substantially agrees with Professor Wanklyn's, and is highly valuable, not only on this account, but because it was taken from the well at so early a date as the 21st October. We can only deplore that an examination of the water was not made at the time of the first appearance of the disease in June, and again more especially at its reappearance in September.

It is remarkable that Professor Wanklyn's analysis of *Mr. Hodgkinson's water* and the *top Town Spring* water should exactly agree with each other in every particular, except that the latter had one-tenth of a grain more *chlorine* per gallon than the former. On taking Dr. Thudichum's analysis of No. 1 well in Leicester Road, which, perhaps, represented as nearly as possible the normal condition of the natural Uppingham water supply, and comparing it with Dr. Anderson's and Professor Wanklyn's analysis of Mr. Hodgkinson's well water, after carefully weighing all the facts, I must come to the conclusion that this latter water was the less pure of the two. For instance, the total amount of *solids* in No. 1 water was 18·75 grains per gallon, that in Mr. Hodgkinson's, according

to Dr. Anderson, was 45·00, and according to Professor Wanklyn, 33·00 grs. Again, if we take *chlorine*, the amount of which, except where geological conditions account for its presence, is so often so true an expression of sewage contamination, we certainly find in Mr. Hodgkinson's water a larger amount than in the Leicester Road water, viz. as 1·5 according to Professor Wanklyn's analysis, and 2·50 according to that of Dr. Anderson's, in Mr. Hodgkinson's well, as against 0·687 in that of the No. 1 well by Dr. Thudichum; and these amounts become insignificant when compared with that in No. 5 well, as shown by Dr. Thudichum to be the least contaminated by this constituent of the *eleven* other wells, in the water of which it actually reached to 7·800 grs. per gallon. According to all the analyses, the amount of free ammonia was exceedingly small, and that of the nitrate actually less than that in No. 1 water, according to Dr. Anderson, the figures being respectively ·200 and 0·700. In conclusion (1) inasmuch as Professor Wanklyn's analysis of Mr. Hodgkinson's water, and the top Town Spring so closely resemble each other; (2) as Professor Frankland's analysis of the top Town Spring water agrees substantially, where they are comparable, with that of Mr. Hodgkinson's by Dr. Anderson; and (3) as this water, when compared with that of No. 1, analysed by Dr. Thudichum, was shown to have excess of *solids* and *chlorine*, I am forced to the conclusion that this water, at the various times when it was examined, was suffering from pollution; and, moreover, I am inclined to express a similar opinion of it to that given by Professors Attfield and Frankland on the top Town Spring, which I will give in the words of the former gentleman:

"In another water, 'Town Spring,' the contamination which is so slight that the total amount of animal and vegetable matter present is not greater than in many districts, is natural to the general water supply derived from rain falling on a large area, and of more or less manured land. But at the same time the amount of this matter in the 'Town Spring' water is so much greater than the amount in an equal volume of the normal water (supplying the Uppingham Wells) seen in the 'Woodfield' water, that I must conclude that the 'Town Spring' too is contaminated, though only slightly. The chemical character alone of this water, would not condemn it, indeed would indicate that it might freely be used for drinking purposes, but when these characters are regarded in comparison with those of the normal water, the conclusion that the 'Town Spring' is contaminated is inevitable."

I believe what is true of the "Top Town Spring" is true of the water of Mr. Hodgkinson's well, but I must say that had all these analyses been before me on the 15th of October, and in the absence of any other cause, I should still have hesitated to accept this water as the cause of the outbreak until I had had much stronger evidence before me than even now I possess. I may add that during the first week of my investigation at Uppingham I tested twenty-one samples of water from different houses, and found that Mr. Hodgkinson's water stood the per manganate test for many hours without changing in the least. One drop of a solution of the per manganate containing four grains to the ounce, was added to five ounces of the sample of water. The "Top Town Spring" behaved in an exactly similar manner.

I have dwelt upon this subject at length, as it was one of great interest during the enquiry, from the fact that a great number of persons in the neighbourhood drank from this spring, although by many it was regarded with suspicion in consequence of its relation to the water supply of the Lower School where the disease had originated.

On examining the position of the water closets and soil pipes I found the private one G was situated close to a bed room in the centre of the main building, and communicating direct by its soil pipe with cesspit No. 3, which also received the sewage from the water

closets D and F. The soil pipe of G passed down the wall of the drawing room and underneath the floor. The only ventilation in this chamber with the outer one was by means of two small trefoil holes opening into two wooden shafts rising to the roof.

The boys' night water-closet was situated against the outer wall. There were also two pan private water-closets in good position. All these soil pipes were ventilated by 3-inch ventilators. I intended to have entered more fully into the details of the sanitary arrangements of this house, having made copious notes at the time of my visit; but since Mr. Rogers Field, C.E., in accordance with your instructions, will fully report on them, I shall content myself by a short summary of the different modes by which sewer-gases had access to the interior of the house.

1. They can enter, and probably did enter by regurgitation which took place from the unventilated cesspit No. 1, through the boys' trough closets.

2. By the same means through the servants' water-closets, from the unventilated cesspit.

3. And, in fact, through all the *four* water-closets, inasmuch as all their soil pipes communicate direct with cesspit No. 3, so that the effect of the ventilation would be to draw the gas through the house. At a subsequent date Mr. Field proved that one at least of these indoor soil pipes was pervious not only to air but to sewage. To test the integrity of the soil pipes, the soil pipe of one water-closet, which passed down one corner of and underneath the kitchen, was cut in two, and plugged with clay at the outlet. Water was then poured in, and although not a drop escaped from the outside clay-plugged orifice, yet the water ran away somewhere as fast as it was poured in; in fact, it was very evident that the liquid materials of the water-closet could soak away somewhere between the upper and lower cut surface, either into the walls or underneath the floor. These defects are too frequently to be found in soil-pipes, and especially in those that workmen are able to hide; for this reason, if for no other, the rule ought never to be now departed from which enjoins that all soil-pipes should be *outside* the house, ventilated above, and *disconnected* below from the drain, so fully and ably explained by Mr. Rogers Field.

We have now seen how the sewer-gases could have access to this ill-fated house, and if there is any truth in the statement that they are capable of producing Enteric Fever, we need not wonder at the outbreaks which has occurred within its walls.

We have seen that this house was totally isolated from the general drainage of the town, and, therefore, even if the sewers of Uppingham had proved to be foul, they could not have been connected in any way with the disease in the lower school.

By your orders the four cesspits have now been emptied, their use discontinued, and a good drain made, under the superintendence of Mr. Tarbotton, into the South Sewer. Other material alterations have been carried out and sanctioned by Mr. Field.

On the 1st October the Fever broke out simultaneously in the families of the Rev. G. H. Mullins and the Rev. W. Campbell. I will take Mr. Mullins's first. There I found that this gentleman's son occupied the night nursery, close to the water-closet. the pan of which was left empty at times, and a smell was complained of from the boys' urinal when the door was left open.

In this house there were 31 boys, eight servants, and five in family; altogether, 44 persons.

Here I was informed that a peculiar connection of the drains of this house with those of Mons. David (where an infant was attacked subsequently) both entering into the south drain. The arrangement will be found described in Mr. Field's report, and therefore I will only state the fact, which was subsequently verified by that gentleman and myself by actual experiment, viz. that regurgitation of the sewer-gases takes places in Mons. David's drain when Mr. Mullins's trough closets are discharged; and, on the other hand, when Mons. David's water closet is flushed, regurgitation takes place through Mr. Mullins's drains. It could not be actually proved that the traps were forced, although it was abundantly demonstrated that a current took place alternately, according to which closet was flushed. There were two water closets, one on the first floor, ventilated by a 2-inch *single* pipe; and another, the boys' night closet, also ventilated. With reference to this peculiar construction it appears that both these were connected with Mr. Mullins's drain. As Mr. Mullins and Mons. David's drains enter the south sewer near each other, it was proposed by these gentlemen that they should employ the same person to trap them each separately. Each party was charged for a separate trap, but it was afterwards discovered that only *one* trap was laid down and made to do the service of two, hence the alternate regurgitation which I have mentioned.

The scullery and housemaid's suites discharged into a closed gulley, and then into the main drain of the house.

I found also that the soil drain passed near the corner of the well, the water of which, although not used for drinking purposes, was pumped up for the bath, the w.c. cistern, and lavatory cistern were used for filling the water jugs. Professor Attfield has examined this water, and I now give its analysis. Before doing so I will mention that the servant's privy empties into the main drain, close by the soft water tank, on the top of which it lies. There is also another well on the west side of the house, 23 feet deep, the water of which is not used except for cisterns.

The drinking water for this house was taken from the "Top Town Spring."

The milk supply from Mr. Wortley, of Ridlington.

On November 20th Professor Attfield condemned the water from the *old well* as unsafe for drinking purposes, and on the 2nd December he distinctly condemned it.

As to the *new well*, the same analyst reported on the 20th November "that the water is of bad quality for drinking purposes," and on the 2nd December, "after analyzing the other well waters of Uppingham, he even more emphatically condemned this water."

I may say that when I tested the *Eastern* well with the Permanganate of Potash, I found it highly polluted, but that the Western one stood the test for several hours. This I reported to Mr. Mullins.

In this house we see then that not only did sewer-gas have a possible access through the faulty arrangements of the drains and soil pipes, but that the water was also certainly contaminated, and although the drinking water was obtained from the "Top Well Spring," yet the water from the house wells was used for the cisterns, and these having taps, and supplying the lavatories, facilitated the use of it, not only on emergencies, but generally contrary to the Master's orders.

In this house there were *seventeen* cases of Fever, viz., two children, two servants, 13 scholars. Five of the latter, however, were attacked after arriving home.

The population consisted of 44 persons: eight servants, 31 scholars, and five in family.

When we take into consideration (1) the close proximity of this house to the one in which the outbreak took place, (2) the general neglect of the early symptoms of the disease in the boys, and their being allowed whilst actually suffering from the disease to play about with their schoolfellows, we can hardly wonder, knowing as we do that diarrhœa often an early sign of its invasion, that neighbouring closets should be contaminated with *Enteric excreta*, and thus conduce to the spread of the disease, especially when the arrangements for the sewage disposal are of such a peculiar character as was to be met with in this house.

On the 15th November, Professor Wanklyn analyzed Mr. Mullins's water; the particular well is not mentioned. He reports, "No. 5 is *contaminated* water." He found 104 grains per gallon of solids, and ·13 parts per million of alluminoid ammonia, which is a dangerous quantity, and very indicative of sewage contamination.

We thirdly come to the Rev. W. Campbell's house. Here the outbreak took place also on the 1st October.

Six cases occurred here—three scholars, two children, and the matron.

The population of this house consisted of 54 persons, viz., 32 scholars, 13 family, and nine servants.

In the first cases, a bad smell was first complained of in the quad, which was attributed to Mr. Williams's ventilating shaft, and by others to the sewer in the High Street. The matron's window looked out on the quad. On these premises was a cesspool, close to the house, ventilated by a 3-inch rain-water pipe running up the side of the house. It was found, as I have before stated, to be completely broken in two, under the ivy, about 3 feet from the ground, just within nose-shot of all passers-by and the window above; this was evidently the source of the smell complained of by the young ladies and the matron.

Near the boys' closet was a study (whose I could not ascertain) which communicated with it by means of a closed window. The boys' night w. c. and the two slop sinks empty into the cesspool; both soil pipes ventilated, and both communicated direct with the cesspool. Another w.c. (private) discharged by a ventilated soil pipe into the south sewer.

The scullery sink discharged with a closed gulley ventilated by a rain-water pipe, and then into the south sewer.

The bath waste pipe and the pantry sink discharge with a closed gulley, unventilated but doubly trapped, thence into the south sewer.

The boys' pantry sink was doubly trapped, discharged into a closed gulley, and ventilated by a rain water pipe, and thence into the south sewer. The slop sink in a stuffy bedroom was ventilated by a 2½ pipe, discharged into a trapped fat box, and thence into the south sewer. This sink used to receive the contents of the chamber-pots.

The main cistern is situated on the second floor, and does not serve the w. c. except through separate cisterns.

The water supply of this house was examined by Professor Wanklyn, and was found

to contain 67 grs. per gallon of solids and 4·2 grs. of Chlorine. This gentleman includes this water in his report as one of five others *not* contaminated. For an Uppingham water however, 4·2 grs. are considerably more than a normal amount, and undoubtedly indicates either past or present contamination. The amount in No. 1 well, according to Dr. Thudichum, was only 0·687.

Here again we find similar conditions to those which obtained in Mr. Mullins's, and the remarks I made with regard to that house are equally applicable to this.

The peculiar feature, however, in this was the broken rain water pipe used as a ventilator to a foul cesspit. This gave rise undoubtedly to the smell, which was supposed, until the fracture in the pipe was discovered, to arise from any place but the premises. The town drain bore its share of accusation. The water here, although it cannot be proved to be a *vera causa* was sufficiently polluted to make it a subordinate factor in the causation.

To the Rev. Mr. Christian's case I have already alluded, and it is my opinion that the disease of the poor boy Nash was not contracted under his roof, but in the manner I have indicated. The sanitary arrangements of this house were far from satisfactory, however, as shown by my own notes and those of Mr. Field.

In Mons. David's house there was an infant attacked. I have no special report to make on this house. The regurgitation of sewer-gases has already been mentioned when reporting Mr. Mullins's house.

The water supply was analyzed by Professor Wanklyn and found to be polluted ; it contained 120 grs. of solids to the gallon, and 14·6 grs. of Chlorine.

In brief, then, I consider all the cases in these houses to have arisen from faults in the arrangements for the disposal of sewage.

Sewer-gases had free access to the houses, and moreover I found the water contained evidence of pollution. I however lay more stress upon the entry of sewer-gases into the rooms, studies and closets, except in the case of Mr. Mullins and Mr. Davids, where the water might have been immediately in fault.

Further and more minute details will be found in the report of your Engineer, Mr. Rogers Field.

I will now append a list of the School Houses, and give the number of cases which have occurred in each house; to this list will be added the Hospital (or Sanatorium), and other particulars relating to the progress of the outbreak.

LIST OF MASTERS' HOUSES, WITH THE NUMBER OF CASES WHICH OCCURRED IN EACH.

Letter on Plan.		Mr. Tarbotton's Number.
A.	Sanatorium.—"Hospital" in my Report. From the 4th October to the 22nd October, 1875, there were *thirteen* cases of Enteric Fever admitted here.	13
B.	Hodgkinson, the Rev. R. J.—House. 27 cases in all, viz.: 18 scholars, 1 son, 2 nurses, and 6 servants. 60 persons live in this house.	4
C.	Candler, H., Esq. There was *one* case of Fever in this house—a daughter; but one of the boys was attacked after arriving home. He only took a few pupils, and these had separate apartments.	8
D.	Mullins, the Rev. G. H. There were *seventeen* cases of Fever in this house against 2 children, 2 servants, and 13 scholars, 5 of the latter were attacked after arriving home. There were 44 persons in this house: 31 boys, 8 servants, and 5 Master's family.	7
E.	Campbell, the Rev. W. There were *six* cases of Fever in this house against 3 boys, 2 of the Master's daughters, and matron. There were 54 persons residing in this house: 32 boys, 13 family, and 9 servants.	5
F.	Williams, the Rev. B. H., M.A. There was *one* case of Fever in this house.	6
G.	Haslam, Esq., The Lodge, High Street. There were *no* cases of Fever in this house.	4
H.	Cobb, C. W., Esq., High Street and School Lane. There were *no* cases of Fever in this house.	3
I.	Rowe, the Rev. T. B., High Street and Orange Lane. There were *no* cases of Fever in this house.	2
K.	Thring, the Rev. Edward, Head Master. There were *no* cases of Fever in this house.	1
L.	Rawnsley, W. F., Esq., Fircroft, London Road. There were *no* cases of Fever in this house.	9
M.	Christian, the Rev. G., Redgate, London Road. There was *one* case of Fever in this house—Nash, who died.	10

Letter on Plan.		Mr. Tarbotton's Number.
N.	Earle, the Rev. W. J., Brooklands, London Road. There were *no* cases of Fever in this house, although a niece who had been there went to Leamington and was there treated by Dr. Thorne. This was the Rev. Mr. Mullins's "*first case.*"	12
O.	Bagshaw, the Rev. W. A. V., Highfield, London Road. There were *no* cases of Fever in this house.	11

LIST OF BOYS IN THE HOSPITAL ON THE 12TH OCTOBER 1875.

Boys Name.		Æt.	Admitted.		Discharged.	Name of Master.
More	...	16	4 Oct.	...	4 Nov.	Mullins.
Walker	...	17	4 „	...	29 „	Mullins.
Nash	...	14	4 „	... Died	21 „	Christian.
Dixon	...	15	5 „	...	27 „	Campbell.
Sing	...	16	6 „	...	23 Nov.	Mullins.
Marsh	...	13	6 „	...	29 Oct.	Hodgkinson.
Knowles	...	15	8 „	...	1 Dec.	Mullins.
Sugden	...	15	9 „	...	6 Nov.	Mullins.
Prior	...	16	9 „	...	13 „	Mullins.
Hamilton	...		9 „	...	10 „	Hodgkinson.
Harcourt	...	9	9 „	...	6 „	Hodgkinson.
Smyth	...	12	9 „	...	8 „	Hodgkinson.
Oldham	...	9	22 „	... Died	23 Oct.	Hodgkinson.

CASES AS THEY OCCURRED IN CHRONOLOGICAL ORDER.

From 21 Sept. to 28 Sept.—Kettlewell, Hastings major.

„ 28 Sept. to 5 Oct.—Mullins, Moore, Walker, Marsh, Nash, Dixon, 2 Campbells, Matron, David, Collard, Bell.

„ 5 Oct. to 12 Oct.—Richardson, Harman, Smyth, Hamilton, Harcourt, Martineau, Perera, Hastings minor, Brucknell, Sing, Sugden, Reedman, Knowles, Prior, Hulse, Crossland.

HOSPITAL.

I will now offer a few remarks on the Hospital, during this outbreak. I naturally expected to find this a model establishment, as I was led to believe that it was under the special superintendence of the school medical adviser, Mr. Bell. I found, however, the same cesspit system existing, and this in an even worse form than in the houses. Although I soon discovered some of the glaring defects with regard to the sewage disposal, yet as the house was full of boys down with Enteric Fever, I felt that it would be untimely and ill advised to initiate alterations until the wards were empty. Soon after the last boy had left, my suspicions were aroused that the sewage disposal system was now more patently defective than I at first anticipated, by the fact that one of the ladies who had nursed her son (Mrs. Walker) had gone to Enfield and died of Enteric Fever.

I immediately proceeded to the Hospital, accompanied by Mr. Rogers Field, who had previously complained of sewer-gas smell in parts of the building. On examining the lavatory on the first floor, near the water closet, we found that a current of cold air could be distinctly felt issuing from the top of the waste pipe of the basin. We then proceeded to examine the outlet of this pipe, and found it partially enclosed in a gulley, the water in which acted as a trap to the cesspit, which of course contained the recent *Enteric excreta* of the invalid boys. The water in the trap was very foul, and gave distinct evidence of saturation and giving off of sewer-gases; and although the gulley cover was perforated, yet it was found to be subject to be rendered impermeable to air either by snow or filth. The outlet of the water pipe opened just an inch or so above the saturated water. After seeing how direct a communication there was between the pestiferous water which trapped the cesspit, I immediately decided to test the character of the air issuing from the plug-hole in the lavatory; this I did by passing the glass tube of an aspirator half filled with a solution of permanganate of potash (4 grains to the ounce). The overflow holes and the plug-hole around the glass tube were then plugged with putty to prevent escape of the air, which was then made to pass through the purple permanganate solution, and almost immediately after the bubbles of air did so discolouration took place, until the whole became of a straw colour, indicating at once the character of the gases which traversed it, and which had been in the habit of entering the building without hindrance.

This is enough to show to what an extent sewer-gases were capable of entering the house called a *Sanatorium*. On examining the water closets, Mr. Field found that the same gases effected their escape into the chambers direct from the cesspit. After this experiment I had little difficulty in accounting for any case owing its origin to residence either partially or wholly within these walls.

At first there was a great want of nurses. This defect was afterwards remedied. The matron complained that all authority over them was denied her, they being exclusively under the control of the medical attendant; and although she found instances of glaring dereliction of duty, yet she was unable to interfere, even under circumstances the most trying. This lady was a highly conscientious officer, and it grieved her much to see the patients under her supervision neglected. The result was that she sent in her resignation, and left so soon as the Hospital was empty.

In Mr. Bell's letter to me he complained that I had interfered with his order, regarding a case in the Hospital. The facts are these: I was in the habit, whenever I had time, of visiting the Hospital before leaving Uppingham. I felt a great interest in

all the cases, and never uttered a word that could be misconstrued into interference, except on this occasion. The poor boy, Sing, had been dangerously ill of Enteric Fever, and moreover had had severe throat complications, which had kept him from sleep for several days and nights. On the occasion referred to, I entered the ward in which he was lying at the moment the nurses were arousing him to give him some nourishment or stimulant. I simply asked if they always did this, and was told that the doctor's orders were to give him nourishment at the hour and the half-hour without fail, whether awake or asleep, and that if asleep he was to be aroused; but they said if we begin to wake him at the hour it takes nearly a quarter of an hour to do so, and then by the time he has taken his nourishment and gone to sleep the half-hour arrives, and the same process has to be repeated.

I felt convinced from my experience, and from the condition of this boy, that sleep was the one thing needed, and I said so. I moreover remarked that sleep was so essential to him at that critical time that he must have it, and that it would do him more good than any nourishment given him in the manner described. The advice was followed, and the boy slept soundly for several hours, and eventually recovered. I could not see a boy struggling for life, and not give him help in the time of his need in the form of advice, which I knew to be sound. Should a similar case occur again, I shall pursue the same course. I can safely appeal to the parents or to my professional brethren, whether, in the emergency, I did not act as I should have done.

CAUSES WHICH CONDUCED TO THE EXTENSION OF THE DISEASE AMONG THE SCHOLARS AND OTHERS.

These I will briefly state. In the first place I cannot help thinking that if the disease had been recognized early in the cases that presented themselves, and parents had been considerately told what was the matter with their children, much mischief and misery would have been averted. I must condemn without reserve the withholding information from those most deeply interested. It was evidently the duty of the medical adviser of the school, when he found what kind of disease he had to contend with, at once to lay the real state of the case before the School Authorities, and advise them how to act, *first*, with regard to immediate information being given to the parents; and, *secondly*, with regard to the necessary steps to be taken by the Masters towards eradicating the cause when he had discovered it.

In the second place, I believe the fact that the cause having been allowed to remain so long undiscovered was the chief feature in the extension of the outbreak. The immediate investigation of the cause of Lord Hawke's son's illness was clearly the duty of the medical attendant, and had this been fulfilled I do not hesitate to say that the September outbreak would have been averted.

And, in the third place, I think that the Head Master promoted the extension of the disease by withholding from the parents the true state of his school, and by intimating to the boys that they were not to inform their parents of the illness which had attacked so many of their schoolfellows. I can only hope that he was really ignorant of the true nature of the disease.

The medical man cannot plead ignorance, for when the first case occurred in June he was informed by Dr. Paley what the disease really was.

The last case that occurred in Mr. Hodgkinson's was one of a very painful character. Whilst the Fever was at its height in this establishment, and the boys were being sent home, a page-boy was engaged, æt. 17. To take his place, he came from Southampton. On his arrival by the Manton Coach, he heard in the Falcon Hotel Yard, for the first time, of the state of things in his new master's house. He replied, "If I had known it I would not have come; and if I had money enough in my pocket I would go back again." Shortly after entering the house he was seized with Enteric Fever in a most virulent form, and died on the 30th of November, after 23 or 24 days' illness.

This case was unreported by the medical attendant, and was discovered by me accidentally whilst testing the integrity of some of the soil pipes in Mr. Hodgkinson's house with Mr. Rogers Field. I cannot help asking your Authority, knowing as you now do, how much evil has arisen from the fact of cases of an infectious and contagious disease having remained unreported by the medical attendant of the school, to take some steps to induce the Legislature to make the reporting of such cases, whether occurring in public or private practice, compulsory on the part of the medical attendant.

The experience I have had during the last three years within my own area induces me to make this suggestion, as I know how important it is that Sanitary Authorities should have the earliest intimation of the existence of such cases.

SITE, GEOLOGY, AND WATER SUPPLY OF UPPINGHAM.

The Site.—There are few towns of England, if any, which can boast of so commanding a position physically as Uppingham.

Situated on a hill, it commands the whole of the adjoining country, and hitherto it has defied the railway engineer. No great highways pass either through or near it, so that tramps carrying disease with them from large towns are not tempted to go out of their beaten track to lodge within it, and leave behind them costly disease germs, besides a pittance for their beds.

It is flanked to north and south by valleys, is thus cut off from the neighbouring villages, and is not easily approached either from the east or west.

Uppingham is about 464 feet above the level of the sea, and therefore is 205 feet above Manton, 295 above Luffenham, 325 above Ketton, 368 above Stamford, 399 above Peterborough, 116 above Market Harborough, 102 above Oakham, 139 above Morcot, 224 above Leicester, 199 above Melton Mowbray, and 448 above Northampton. In fact it stands on an average upwards of 200 feet above any of the neighbouring towns and villages from Leicester to Peterborough.*

It is well situated on its hilly site for draining, which has been carried out to a great extent on the contour system.

It is surrounded by beautiful scenery, and some of the best land in England is to be found on the neighbouring uplands and meadows.

Geology.—Well situated as it is physically, Uppingham enjoys also a warm, dry soil, filled with beautiful springs, the water of which is all that can be desired. I am speaking now of the natural condition of the water, as it would be indeed, even now, had cesspits and their allied abominations never been thought of.

The formation on which the town stands is a member of the Lower Oolite series, called, from its prevalence and typical character near Northampton, after that town, the *Northampton Sand.* This formation varies in character in different parts, and even within very short distances, and a knowledge of this fact is necessary when the question of water supply has to be answered.

As this question now is uppermost, and as it becomes my duty to advise your Authority on this important subject, I must be pardoned if I give a short outline of what Uppingham stands upon.

Uppingham is built on the highest point of a large outlier of *Northampton Sand*, the ridge of which has nearly a north and south direction. To the east this outlier is deeply denuded by the streams which flow from the sides towards the east to fall into the River Welland.

These valleys, from Stoke Dry to Preston, are *seven* in number, and are passed over by the London Road, between the two last places.

These *seven* streams have worn their way through the *Northampton Sand* down to the *Upper Lias Clay;* in fact they have their sources, in many instances, between the junction

* For these altitudes I am indebted to the kindness of G. J. Symons, Esq., the well-known author of "British Rainfalls."

of the pervious ironstone rock of the *Northampton Sand* and the impermeable *Upper Lias Clay.*

The state of the *Northampton Sand* differs greatly in different places, as I before stated. In the *higher* parts of *Uppingham,* for instance, this formation has not been subject to subærial influences to the same extent as at lower levels, where the protecting influence of the estuarine clay has been removed. This clay is well illustrated and the rocks beneath it, in a new well lately sunk to the north of the Stockerston Road.

I have inspected this section myself, and Mr. Frederic James has kindly furnished me with the admeasurements, which are as follows :—

Fig 1.

	Feet.	Inches.
Soil A . . .	1	9
Estuarine Clay B	1	3
Kale C . . .	8	6
Rock D . .	8	6
Upper Lias Clay E		

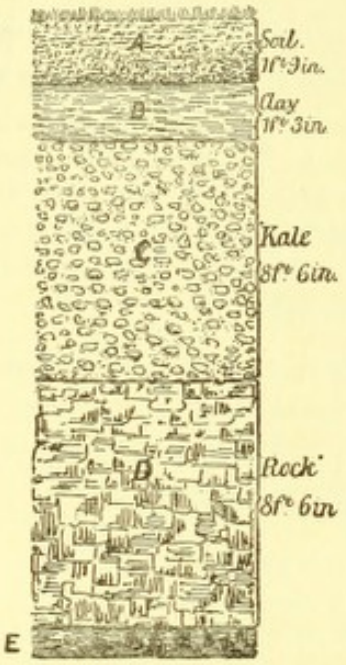
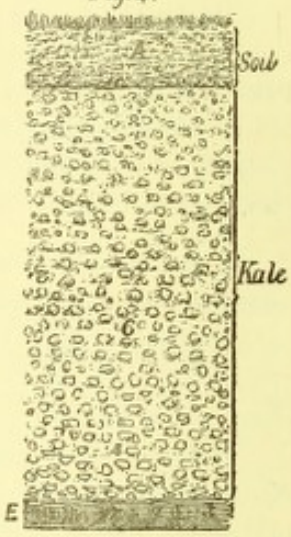


Fig. 2.



These admeasurements and order of super position agree well with what Mr. Judd has given. Why I wish to be particular on this point is, that you should the more easily understand why some wells in and near the town, are more susceptible of pollution than others. It must be understood that what the well-sinkers and quarrymen call "kale" and "rock" are both *ironstone.* The *first* has been, however, *weathered* by the action of rain and air, and the *second* has not been subjected to this process, having been protected by the superincumbent layers of ironstone and clay; in fact, the weathering process has not reached so far down; so that the *blue rock* retains its character of *carbonate of iron,* whilst in the upper layers it has yielded up its carbonic acid, and been converted into a hydrated per-oxide of iron, which constitutes the *ironstone* that is now quarried so extensively.

The *thinner,* therefore, that this ironstone is, and when the clay (B) has been carried away by denudation, the mass becomes more exposed to subærial influences, and the more completely does the rock become weathered. In such spots (and these are to be found on the flanks of the denuded slopes) percolation easily takes place from above, in consequence of the absence of this clay (B). Manure heaps, under these circumstances, would be fruitful sources of pollution, and undoubtedly they have done their share.

From cesspits there is no protection, as they are invariably sunk below this band of upper clay (B), and, therefore, operate alike in the deep strata as well as the shallow;

with this difference, however, that a longer time, *cæteris paribus*, would be taken to poison the deeper wells than the more shallow. There is a curious fact connected with this difference in the well pollution of Uppingham. We have every reason to believe that the springs in and about the town come from the N.W.W., in fact, in a similar direction to that which the sources of the seven streams before mentioned take.

This can be shown in the instance of the *Town Spring*, which passes diagonally under Mr. Hodgkinson's house (B) after supplying the well at the Hospital (A) in its course to the outfall, where it is known by this name.

It is also probable that the same spring from which the pump in the Leicester Road derives its supply of water, passes parallel to this Town Well Spring, and supplies wells to its S.E. in the lower part of the town, viz., Nos. I, II, V, VI, IX, X, XII. At all events it is remarkable, and may be most instructive to notice how the water in these wells show increasing signs of pollution the further they go from the pure source at Well I. For instance, let us take the Leicester Road Well, No. I, as the standard of purity for these wells at least, and trace the progress of pollution towards the S.E., and again let *Sodium Chloride*, as the best expression of pollution from human sewage, be the peccant constituent:

N.W.

No. of Well.	Sodium Chloride.
I.	1·6401
II.	14·4100
V.	14·6500
VI.	20·4518
IX.	21·5090
X.	30·6000
XI.	35·7060
XII.	26·9800

S.E.

Again, if we take the remaining wells to the north, and presume that there is another parallel spring supplying them, we shall find a very similar sequence of pollution:

N.W.

No. of Well.	Sodium Chloride.
III.	16·4500
IV.	19·8990
VII.	21·3840
VIII.	23·3100

S.E.

Now these two series tell a singular tale, which may be fraught with warning.

It must be remembered that all these analyses were made by one of the most painstaking and eminent chemists of the day in this or any country, Dr. Thudichum, of the Medical Department of the Privy Council; and, moreover, they were made when the waters were at rest and undisturbed by heavy rains. The samples were drawn in May, 1875, and during one of the driest quarters we have had for more than half a century.

These waters could not have been analyzed at a more favourable time for ascertaining their general character.

Dr. Thudichum remarked that "No. 1, the Leicester Road Well, was exceptionally *pure* and *soft*, and very good for domestic use."

Now, I must tell you that in this locality *softness* is a character which is not only valuable in itself, but is to a certain extent an indicator of purity.

You must remember that the springs here are not derived from rain which has to pass through calcareous or limestone rocks. The rain that falls in this locality has little means of dissolving lime in its passage through the porous and ferruginous Northampton Sand. In such a case, when we want to account for hardness, we must look to the combinations which are made by the powerful acids, sulphuric and nitric, which are found in combination with bases, as the constituents of sewage and other polluting matters.

These bases and the acids combined with them are to be found when the samples have been evaporated to dryness. Let us see again how these solids increase from the north-west to the south-east, taking the whole series of twelve samples.

	N.W.	
No. of Sample.		Total Solid Residue in Grains.
I.		18·750
II.		90·280
III.		141·320
IV.		63·750
V.		76·230
VI.		95·634
VII.		98·400
VIII.		99·790
IX.		97·020
X.		138·600
XI.		174·630 !
XII.	S.E.	174·630 !

The notes of exclamation are Dr. Thudichum's, and well indeed might he exclaim. You must remember that when you sent these samples to Dr. Thudichum he did not know where they came from, and certainly knew nothing of the positions of the respective wells from which they were taken in the town.

He analyzed them and gave a truthful report of their polluting constituents, and we now see how strange a tale they tell when placed on the plan of the town.

Dr. Thudichum in his report says "all the other waters (except I) were at *one time* heavily contaminated with sewage; but this in the course of long percolation has become almost entirely oxidysed, so that the albumenoid ammonia is inappreciable, whereas the nitrous and nitric acid rises in all to a very high degree, in some to an enormous quantity. All those waters in which the *quantity* of *potassium* is larger than that of *sodium*, as chloride (III, VI, VIII, XI, XII) must be considered to have been mainly contaminated by *animal* sewage; those in which the reverse obtain, *i.e.* where the *sodium* predominates (II, IV, V, VII) were originally contaminated by *human* sewage; in waters Nos. IX and X, both *animal* and *human* co-operated to produce the result. All these waters are eminently *hard*, and for this reason, and on account of the large amount of *sulphuric acid* contained in them, either as *gypsum* (sulphate of lime) or *potash salt*, are very unsuitable for domestic purposes.

For drinking, these waters may be considered to be indifferent in their present state, that is to say probably not injurious, but possibly dangerous, inasmuch as there is a possibility of the sewage which now penetrates slowly, reaching the water quickly and unoxydised in time of flood or high ground water. The amount of this danger can be appreciated only by a direct inspection of the wells, and a consideration of their depth and of the strata in which they are situated.

We have now seen that, at all events, Uppingham has a very pure water supply, close at hand in the neighbourhood of the Leicester Road Well; we have also seen that this pure supply gets polluted more and more as it passes through the town.

You must remember, gentlemen, that what has occurred once, may, and in all probability will, occur again; therefore we may expect at any time an invasion of fresh sewage matter where oxydized matter is to be found now. The present state of things cannot remain stationary, whilst cesspits and manure heaps are allowed to have an existence within the area of the town.

It appears, therefore, to me that I have no other course but to recommend you at once to take steps to eradicate a system which has been so detrimental to the naturally good water of the town.

This can easily be done to the south of High Street, for the town constructed at a great cost some three years ago a good and efficient sewer along the Stockerston Road, down the Back Lane to the extreme south-east of the town.

Had advantage been taken of this sewer by the school authorities three years ago, I should not have had now to write a report upon a fatal outbreak of Enteric Fever within their walls. It seems to me incredible how any one having the charge of so many tender and precious lives could have gone on living surrounded by reeking cesspits, used daily by fifty or sixty people, when the town had brought a good sewer to their doors, at a considerable expense, purposely that it should be used to avert disease and death.

With regard to that part of the town north of High Street, and along its north side, the difficulty begins if the cesspits are done away with. There are two alternatives: one, that a dry system of sewage disposal should be adopted as a substitute for the cesspit system, and the other the water carriage system. In any case there is a necessity for a further and purer water supply, and when this has been obtained it will be available for flushing the closets and the sewers, and a new drain will have to be carried at a lower level than the present insufficient one, which hardly carries any sewage at all, in consequence of its not being deep enough for the closets, many of which are below its level. In this case the old sewer would do well to remain and be used as a surface drain. In making a new sewer your Authority is not under the difficulty that is so frequently met with—the disposal of the sewage. The town is already provided with a Sewage Farm, which, although in a bad position as regards the approach to the town, may, under proper management, be made to serve its purposes.

The question, gentlemen, then, for you to decide upon is whether you will adopt the dry system or the water carriage system.

If you decide upon the former, I am authorised to say that the Goux Company are ready to provide you at once with plant for 30 tubs free of expense, provided you wish to try the experiment of their system. You are aware that this system has been adopted in Halifax for some years, and there the Sanitary Authority are so satisfied with its results that they have determined to work it themselves, with the view of testing its capability of paying its own expenses.

One thing is certain, and that is the necessity of doing away with cesspits, for in the porous soil of the Northampton Sand they are as dangerous as when embedded in a water-bearing stratum of gravel. Manure heaps must not be allowed within the precincts of

the town without well-cemented beds and proper means of carrying off the drainings from them; and all farm buildings must be spouted; and, lastly, whatever system you adopt, the scavenger and his cart will be indispensable under your immediate authority. You well know, gentlemen, how often the removal of nuisances has been delayed on account of the poorer classes not having the means of carring out your orders. I firmly believe that regular scavenging would do away with a large amount of the evils complained of, and at the same time have a good moral effect on the people by teaching them the advantage of cleanliness over filth. As Mr. Simon has well observed, *Enteric Fever* is one of the *filth diseases*, and until fever is starved by cleanliness we shall ever find it ready to burst out of a cesspit, or be pumped out of a well. Whether a cesspit open into a cupboard, as it did at Hudson's, or its gases escape into neighbouring studies, as they did at Mr. Hodgkinson's, it matters little, the results will be very similar; and so long as these abominations are allowed to cumber ground that otherwise would be wholesome and sweet, we must expect the consequences, and be prepared to pay the penalty, heavy though it be, as in the late lamentable outbreak.

THE VITAL STATISTICS OF UPPINGHAM DISTRICT.

If we compare the average annual proportion of deaths from specified causes, at specified ages, in the district of Uppingham with that which obtains throughout England and Wales, we shall find that the comparison will prove highly favourable to this district. For instance, let us take the decennial period, 1861–70.

DEATHS PER 1,000 LIVING OF EACH CLASS REFERRED TO.

TABLE I.

Causes and Ages.	Uppingham.	England and Wales.	Difference Plus + Minus — Uppingham.
At all ages—			
All causes	18·46	22·42	— 4·96
Enteric Fever	·54	·88	— ·34
Diarrhœa, Dysentery, &c.	·47	1·08	— ·61
Scarlet Fever	·90	·97	— ·07
Diphtheria	·13	·18	— ·05
At less than 1 year of age	139·39		
All causes	139·39	180·41	—41·02
At less than 5 years of age—			
All causes	46·32	68·30	—21·98
Diarrhœa, Dysentery, &c.	2·22	5·98	— 3·76
Diseases of Respiratory Organs, including Phthisis	6·04	11·04	— 5·00
Small Pox	·19	·65	— ·46
Scarlet Fever	4·45	4·62	— ·17
Measles	2·22	3·00	— ·78
Whooping Cough	2·10	3·77	— 1·67
At ages between 15 and 55—			
Phthisis Males	2·28	3·68	— 1·40
Phthisis Females	3·68	3·74	— ·06
Other Diseases of the Respiratory Organs Males	·94	1·32	— ·38
Other Diseases of the Respiratory Organs Females	·76	·91	— ·15

Again, if we take the above figures and compare them with those attached to the healthiest districts in England, and for this reason formed into a standard group of rural districts, we shall find that that of Uppingham does not suffer much when put to this severe test. For instance, during the decennial period selected, 1861–70, its *General Death Rate* was only 1·96 per 1,000 living, in excess of the healthiest districts in England; its *Fever Rate* only ·14 in excess, whilst its *Diarrhœa Rate*, both at *All Ages* and at *Less than Five Years of Age*, was actually less, being respectively ·10 and ·63 below that of the standard growth. *The Scarlet Fever Rate* was higher. We must, however, remember that the decennial period included the fatal year 1870, when there were 24 deaths from this disease in the town three of whom were among the boys

of this school. The death rate from this cause amounted to ·35 *at All Ages*, and 2·41 at *Less than Five Years of Age* in excess of that of the standard group. The *Diphtheria Rate* was lower than in the standard group by ·15.

There was also less *Small Pox* by 0·9.

The *Measles Rate* was in excess by ·96. That of *Whooping Cough* was less than the standard, by ·60. With regard to *Consumption* (Phthisis), there was less in the Uppingham district among males by ·69, and *more* among females by ·97, than in the standard group. The same obtained with regard to other diseases of the respiratory organs.

In the district of Uppingham the rate of mortality among children was greater, being in excess by 25·79 *at Less than One Year* of age, and by 6·16 at *Less than Five Years of Age*.

TABLE II.

Causes and Ages.	Uppingham.	Standard Group of Rural Districts.	Difference Plus + Minus — Uppingham.	Difference Plus + Minus — Oakham.	Difference between Uppingham and Oakham.
At all ages—					
All causes	18·46	16·50	+ 1·96	+ 3·02	— 1·06
Enteric Fever, &c.	·54	·48	+ ·14	+ ·25	— ·11
Diarrhœa, Dysentery, &c.	·47	·57	— ·10	+ ·27	— ·17
Scarlet Fever	·90	·55	+ ·35	+ ·28	+ ·07
Diphtheria	·13	·28	— ·15	— ·06	+ ·09
At less than 1 year of age—					
All causes	139·39	113·60	+ 25·79	+ 35·42	— 9·63
At less than 5 years of age	46·32	40·16	+ 6·16	+ 6·32	— ·16
Diarrhœa, Dysentery, &c.	2·22	2·85	— ·63	+ ·54	+ ·09
Diseases of the Respiratory Organs, including Phthisis	6·04	6·57	— ·53	— ·83	— ·30
Small-pox	·19	·28	— ·09	— ·28	+ ·19
Scarlet Fever	4·45	2·41	+ 2·41	+ ·84	+ 1·57
Measles	2·22	1·26	+ ·96	— ·15	+ ·81
Whooping Cough	2·10	2·70	— ·60	+ ·20	+ ·40
At ages between 15 and 55—					
Phthisis Males	2·28	2·97	— ·69	+ ·16	+ ·47
Phthisis Females	3·68	2·71	+ ·97	+ 1·06	— .09
Other diseases of the Respiratory Organs Males	·94	1·02	— ·08	— ·16	+ ·08
Other diseases of the Respiratory Organs Females	·76	·53	+ ·23	+ ·29	— ·06

THE VITAL STATISTICS OF THE TOWN OF UPPINGHAM.

In towns we expect to find not only a higher general death rate, but a higher mortality from certain causes, especially those of the so-called Zymotic diseases, all of which are (more or less) preventable, than in the rural districts generally, and than in the rural part of the district in which the town is situated.

Uppingham is the largest town in the district; it contained (1871) 446 inhabited houses, occupied by 2,601 persons; it had 280 inhabited houses, and 1,987 more persons residing in it than Hallaton (Leicestershire), which is the next largest parish in the district. The estimated population in the middle of 1875, was 2,800.

According, therefore, to the rule that towns have a larger death rate than rural districts, we should be naturally led to infer that Uppingham, being so much larger a place than any of the 37 parishes comprised within the boundaries of the district, would have a higher death rate. *Uppingham*, however, forms a notable exception to this rule.

If we take as standards the death rates of this district for the ten years 1861-70, we shall find that the mortality for the four years, preceding the one in which the late outbreak took place, to be actually below the average of the district.

For instance, the average annual general death rate, *i.e.*, from all causes, at all ages, for the four years 1871, 1872, 1873, 1874, did not exceed 13·4 to every 1,000 persons living; or 5·06 less deaths than was the average annual death rate for the whole district during the ten years 1861—70, and 3·10 less than what obtained in the Standard Rural Districts during the same period. The fever rate for Uppingham District was ·54, and in the Standard Rural Districts was 48. In the town of Uppingham during the four years specified it only amounted to ·09.

Again, if we include the two exceptional years, 1870 and 1875, when *Scarlet Fever* and *Measles* prevailed in the former, and *Enteric Fever* and *Scarlet Fever* in the latter, the accompanying Table (III) shows that the normal death rates of the town both from *all causes* and from those of the *Zymotic class*, are so low as to enable it to stand out in favourable contrast with the district in which it lies, and, as regards the Zymotic class and Phthisis, to show a lower mortality than obtained in the Standard Rural Districts, even under the above-named visitation of epidemic and endemic diseases. For instance, the death rate from *all causes* during the six years, 1870—1875, amounted to 17·35 to every 1000 persons, being as against 18·46 in the whole district, and 16·50 in the Standard Rural Districts (1861—1870); that from the *seven principal Zymotic diseases*, 4·75 against 6·55 in the district, and 7·71 in the Standard Districts; and that from *Phthisis* 0·61 against 2·98 in the district, and 2·84 in the Rural Districts.

These figures require no further comment: they prove incontestably that the town ranks high in the scale of health: and that even when its population is adventitiously augmented by a large accession of persons of an age particularly prone to succumb to Zymotic diseases, crowded together in houses where the sanitary arrangements have been proved to be defective, Uppingham stands out prominently, whether compared with its own district, the Standard Rural Districts, or the Country at large, as one of the healthiest towns in England, and eminently well calculated for the site of a school, provided the school authorities render impossible the existence of Endemic causes of disease within their houses.

TABLE III.

Mortality from All Causes and Certain Specified Causes in the Parish of Uppingham in each of the six years 1870—1875.

Years.	Estimated Population in the Middle of each year.	Total Deaths.	Deaths from the Seven Zymotic Diseases.	Small Pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	Fever.	Diarrhœa.	Phthisis.	Deaths in Workhouse.		Annual Rate of Mortality per 1000 lives.		
														Total Deaths.	Seven Zymotic Diseases.	Phthisis.
1870	2,567	72	33	....	6	24	....	....	3	....	2	6		26· 5	12· 9	0· 8
1871	2,612	41	2	....	2	....	....	....	....	....	3	9		13· 4	0· 8	1· 1
1872	2,658	38	6	4	....	....	....	....	...	2	1	15		10· 5	2· 3	0· 4
1873	2,705	58	12	....	....	....	....	9	1	2	2	10		18· 9	4· 4	0· 7
1874	2,752	36	4	....	2	....	....	....	....	2	....	9		10· 9	1· 5	0· 0
1875	2,800	67	19	....	....	8	3	....	8	....	2	10		23· 9	6· 8	0· 7
													Uppingham Town.	17·35	4·78	0·61
Totals	....	312	76	4	10	32	3	9	12	6	10	59	Uppingham District.	18·46	6·55	2·98
													Standard Rural Districts.	16·50	7·71	2·84

THE SCHOOL MANAGEMENT IN RELATION TO THE HEALTH OF THE SCHOLARS AND THE LATE OUTBREAK.

THE BOYS' DORMITORIES AND STUDIES IN THE SCHOOL.

Dormitories.—During this investigation the question has been asked by parents whether your Authority could not enforce the house Masters to give to each boy at least as many cubic feet of breathing space as are required to be given in our Union houses; it was doubted whether in some houses the boys have nearly as much.

You will remember in my History of the Outbreak I mentioned having been particularly struck during one of my first visits with the want of cubic space, and that I determined to enquire into this matter. I now will give the results. Your Authority will remember that in your district, and throughout my sanitary area, I have decided that 300 cubic feet ought to be the *minimum* amount tolerated, and that when a lower amount obtains, action should be taken against overcrowding.

With regard to the pertinent and important question as to your power to enforce as much cubical space as is enjoyed by the inmates of Union houses, I may answer generally that, should your Authority become informed of the existence of overcrowding in the Masters' or any other houses, you would at once interfere and put the law into force. Another question has also arisen as to whether the Masters' houses ought to be considered as lodging houses, and be subject to the same supervision, both with regard to the cubical space provided for each inmate, and other regulations, especially those defining the duties of the lodging-house keeper in cases of their houses becoming infected by diseases of infectious and contagious character, like Enteric Fever, Scarlet Fever, &c. If those houses are not in the same category as common lodging houses, they ought to be, as the best means of affording protection to their inmates, whose age necessarily precludes them from judging what is best for their health in these matters.

I think all medical men will agree with me that boys whose lungs are well inflated, and muscles actively exercised daily at football, cricket, and other athletic sports, are less tolerant of a cramped "study," or an overcrowded "dormitory," than those who lead a less active life; and that when limited to a confined space for sleeping or studying in, are apt to suffer in health more than those of less active habits.

I will now give the facts relative to the cubic space of the "dormitories" and "studies" in some of the school houses. I instructed Mr. James, the Inspector, to take the proper dimensions of these chambers, and he was assisted by a competent cabinet maker in the work. Commencing with the highest amount provided in the dormitories, I find from an analysis of the admeasurements the following results.

Between 700 and 750 cubic feet to each person—1 dormitory containing 3 beds.

Between 700 and 650 cubic feet to each person—1 dormitory containing 15 beds.

Between 650 and 600 cubic feet to each person—none.

Between 600 and 550 cubic feet to each person—none.

Between 550 and 500 cubic feet to each person—3 dormitories containing 14 beds as a total.

Between 500 and 450 cubic feet to each person—9 dormitories containing 52 beds as a total.

Between 450 and 400 cubic feet to each person—9 dormitories containing 71 beds as a total.

Between 400 and 350 cubic feet to each person—3 dormitories containing 25 beds as a total.

Between 350 and 300 cubic feet to each person—3 dormitories containing 33 beds as a total.

The averages being for the houses examined as follows—

In B.	540	cubic feet	to each scholar.
„ E.	474	„	„
„ K.	460	„	„
„ F.	428	„	„
„ I.	410	„	„
„ D.	410	„	„
„ G.	409	„	„
„ H.	346	„	„

Such a state of things cannot be conducive to health, especially where boys are concerned whose bodies and minds are ever in activity. Mr. Thring in his manifesto says: "The school is not a barrack." Had it been so, and under proper barrack regulations, his boys would at least have had 600 cubic feet, or more, instead of being overcrowded, as the above figures show they are. At the Daventry lock-up, which I measured lately, each prisoner sleeps in a room having at least 1000 cubic feet. No boy should have less than 800 cubical space, although 750 has been considered adequate.

The studies I found ill ventilated, and some without any ventilation at all. Heated by hot water pipes, and every breath of air excluded during the cold weather, in fact reminding me of some of the stuffy rooms, which I am so frequently obliged to condemn. The following admeasurements have been obtained—

I.	335	cubical space.
D.	308	„
E.	292	„
B.	275	„
F.	267	„
K.	238	„
H.	234	„
G.	230	„

SCHOOL REGIMEN AND ROUTINE.

A growing boy, like any other growing animal, must be judiciously fed and exercised, if it be desired to make the most of his inherent mental and physical powers, especially when both are often severely taxed as at school. There must not only be abundant good wholesome food, but there must be great judgment exercised in distributing the supply during the hours of activity.

At an age especially prone to succumb to certain forms of disease, such as *Enteric Fever*, the stomach is the one organ that needs the most watchful care. In youth the stomach must be *naturally satisfied, not artificially appeased.* If a well-distributed, wholesome supply of nutritious food be within the reach of a boy, as a rule you will not find that boy gorging himself at all times, whenever he has a chance, with indigestible stuff, simply for the sake of eating. Cases there are, we well know, of morbid appetites; these are, however, to be treated medically, and even in many of these the most sure cure is a well-distributed nutritious diet.

In these remarks I have been led by the complaints of parents, and of the boys themselves in the Uppingham School, of the diet routine in many of the houses.

The first complaint is that the boys frequently go early to their form-masters, sometimes at a long distance, to take their lessons, with empty stomachs; returning to the Master's house with whom they reside, to breakfast at 8.30 or 9 a.m: this meal consisting merely of bread and butter and tea.

The effect of this is to tempt the boys on their way to their lessons to expend their pocket-money in buying all kinds of stuff at the pastry-cook's on the road.

They dine at 1.30 p.m., and from all I can hear are provided with a good substantial meal of meat, pudding, vegetables, and beer.

At 6 p.m. they have a bread and butter tea; after which, until the next morning at breakfast, they get nothing, unless they take bread and water, or their parents pay something extra for a modicum of cheese.

Such a system requires no comment. A boy's empty stomach has neither conscience nor discretion; and surely if the present fees for board and lodging are not sufficient to keep this organ out of temptation, and to preserve it from being too open a portal for the entrance of *miasm* in some form or other, the parents should be informed of the fact, and not allowed to remain under the impression that they are expending enough on their boys to insure them plenty of wholesome and well-distributed food, whilst their boys are expending their pocket-money incontinently in filling up gaps in their stomachs caused by a "regulation" fast of 12 or 14 hours' duration.

It is impossible to estimate how often the empty stomach in the morning might have

favoured, during the late outbreak, the invasion of the disease, the poison of which had been so long lingering about the different centres of infection.

A boy should always start in the day with a good substantial breakfast, and after the fatigues of play and study should end it with a hearty supper of good, wholesome, and easily-digested food.

Nothing predisposes to disease more than indigestible food, especially when the bowels are the seat of the disorder, as in Enteric Fever; and the only rational mode of keeping the stomach out of temptation is to supply it with wholesome food at proper intervals, recollecting that young stomachs should never be allowed to be empty, for when they are their temptation begins.

SUMMARY.

It is my opinion that the first case in the outbreak of Enteric Fever, which was reported to your Authority on the 13th of October, 1875, was that of Lord Hawke's son, who died of this disease on June 24th of the same year, in the Rev. R. J. Hodgkinson's house.

After a minute and careful investigation into the causes of the attack of Arthur Kettlewell, æt. 13, in the house of the Rev. R. J. Hodgkinson, Head-Master of the Lower School, on the 21st of September, 1875, I am of opinion that his illness, Enteric Fever, was produced by being exposed to the influence of sewer-gases, emanating from the unventilated cesspool (No. 1) at the north-west corner of the Master's house.

I am of opinion if the first symptoms of fever, in the case of Lord Hawke's son, had been properly recognized at first, the actual nature of the disease ascertained, and the causes properly investigated by the medical attendant, that Mr. Hodgkinson would have at once remedied any defect in the sanitary arrangements of his house pointed out to him, and would have at once connected his house with the main drainage of the town, and have thus averted the calamity which has befallen other pupils.

I am of opinion that the same causes of the outbreak of Enteric Fever which existed just before the disease attacked Master Kettlewell, on the 21st September, 1875, also existed at the time of, and before the attack to which Lord Hawke's son succumbed on the 24th June, 1875. Both cases occurred in the same house.

After carefully reviewing the analyses of 51 samples of water obtained from the public and private wells in Uppingham, the majority of the latter belonging to the School-Masters' houses, I have come to the conclusion (1) that all, with the exception of No. 1 (the Leicester Road Well), analyzed by Dr. Thudichum, are more or less polluted; and (2) that the pollution is not of recent date in many instances, especially in those samples from wells examined by Dr. Thudichum. These fifty-one samples were examined by Professor Attfield, Dr. Anderson, Professors Frankland and Wanklyn, and myself.

It is a fact that the well waters on the premises of the Rev. Mr. Mullins, the Rev. Mr. Campbell, and Mr. David, were found polluted and unfit for drinking purposes.

Whilst, however, I state this to be the conclusion at which I have arrived, I do not associate the *origin* of the fever with well water pollution. I attribute it entirely to the effect of sewer-gases, which I have shown existed to such an alarming extent in the boys' trough closets at Mr. Hodgkinson's.

Although it is a fact that the pollution of the well waters submitted to Dr. Thudichum was not of recent date at the time of analysis, which was performed on samples taken from wells after a dry season, in May last, it does not follow that these waters, if they had been examined after the heavy rains of the late autumn, would not have shown evidence of fresh pollution. On this point we have no evidence, unfortunately, as none of the waters examined by Dr. Thudichum have been analyzed by any of the other analysts, either before or since the outbreak.

It is a fact, however, that in the south-east part of the town where the wells X. XI. and XII., stigmatised as the most polluted of all the twelve, exist, there has been no authenticated case of Fever.

It is a fact, as before shown, that the water of the wells increases in impurity from the north-west to the south-east part of the town.

It is a fact that whenever well-authenticated cases of fever have occurred in the town, their origin could either be traced to *immediate local causes, or else to the person afflicted having been within the area of a centre of infection.* The case of Hudson, near the toll-bar, will illustrate the first set, and the Coventry nurse and Mrs. Walker, of Enfield, the second.

The fact, however, that there is so general a pollution of the well water, both public and private, of Uppingham, and the knowledge that when pollution has once gained access to a well, that well may at any time be invaded from the same, or a similar source, induce me to recommend your Authority to procure a fresh and pure water supply for the town.

You will remember that in the three infected houses B., D., and E., there originated 50 cases, if not more, of Enteric Fever, among a joint population of 158 persons, or 31·6 per cent.

This is an enormous disease rate, and will be better understood when this per-centage is applied to the town itself. Omitting the school population, and taking the population at 2,000 and the per-centage at 30, there would have been *six hundred people* down with fever within two months. I do not use this illustration for the sake of magnifying what has already proved too great, but to show how we ought to read the lesson that has just been given. This outbreak of Enteric Fever increased from *two* cases in the first week to 12 in the second, and 16 in the third, so that had a check not been put to it, it would, in a very few weeks, have involved the whole school, and in all probability the greater part of the town.

The reason why this obtained, was the fact that three weeks elapsed at least before any attempts were made to discover the causes, and therefore the same causes were allowed to do their work in their usual manner, for each case extended the area of their operations, and wherever the system for sewage disposal was defective, there the imported disease revelled.

Knowing, therefore, what has been the amount of disease in the school houses, and knowing too that the same kind of fever has occurred since the outbreak among some of the town people, and that the water of the town is capable of pollution, like the wells in the school-houses, it becomes a matter for your grave consideration, whether you will allow the present water supply to remain with all its inherent danger augmented by this outbreak, or at once procure another and a purer one, and thus avert a danger before you are forced to do so by its presence.

I strongly recommend you, gentlemen, to establish a fresh public water supply for Uppingham under the controul of your Authority, for only by such means can you guard against the present and future influence of the disease that has so lately visited the school.

Your Engineer, Mr. Rogers Field, will report to you on the public and private drainage of the town, and I am glad to know that he will strongly recommend you to abolish the cesspit system where practicable.

There are many places in Uppingham which require the vigilant supervision of your

Inspector, but I think much good will be effected, when you have decided upon the system of sewage disposal you intend to adopt, by the regular visit of the scavenger.

I have visited and inspected the south drains and the High Street Sewer, with Mr. Rogers Field. With few exceptions, the former was found free from accumulations; in fact it was in remarkably good order, and I believe that the system of ventilation that is being carried out in this and the High Street drain will be of great service.

I have already alluded to the two alternatives with regard to the sewage disposal of the town. All I can say as your Medical Officer of Health is that I only desire to see that system adopted which shall be the most efficacious; and I feel convinced, from the careful manner in which the whole subject has been dealt with by your Engineer, that he will well advise you.

With regard to the school-houses, I understand that in the majority the necessary alterations and additions in their sanitary arrangements are being pushed forward. Whilst these are being carried out, I should like your Inspector to report to me as to what has been done towards disinfection since the alterations have been made.

I would recommend the doing away at once with the bathing pool—at least, it is advisable that the boys should not be allowed to enter the water.

Having already alluded to the management of the school-hospital and its sanitary arrangements in relation to the last and any future outbreaks, I shall not add anything further, except that I would advise the abolition of the cesspits on its premises, and that a drain be carried from it into the south sewer. In its present condition, and with the present mode of sewage disposal, I do not consider it a safe resort for either the sound or the diseased. I need only refer to the experiment which Mr. Field and I made to prove the existence of sewer-gases in the house.

It must be remembered that the cesspit is full of the excreta of Enteric cases, and that the poison of this disease is not only active, but enjoys great vitality. Every particle of the sewage that is taken from that cesspit ought to be submitted to the action of strong acids or of strong acid salts, such as the persalts of iron. This is a matter of the greatest importance, as the escape of any of this sewage might prove most dangerous to a whole community. At all events, it must be disposed of where there is no chance of its being soon disturbed.

Until the arrangements have been altered that now admit of sewer-gases into the house, this place ought not to be used.

To the management of this Hospital, in relation to the late outbreak, I have already sufficiently alluded. Like its sanitary arrangements, it requires a complete remodelling.

I must also urge upon you to recommend the School-Trustees to enquire into the overcrowding of the school-houses, the details of which I have given. Having received, as I have said, letters from parents bitterly complaining of this want of cubical space, I was induced to make enquiries, and I must say the results have surprised me. Some of the boys have no greater cubical space allowed them than is to be found in some labourers' cottages. Every boy should have at least 750 or 800 cubic feet, instead of only 400 or 500 as at Uppingham School, where there are many instances of cubical allowance in the dormitories not reaching the lowest of these two amounts.

As to the *Studies*, these also require remedying, in fact they cannot be called Studies.

It is absurd to suppose that a boy can study in an unventilated box, without a fireplace, and heated in the winter by a hot air pipe. It will be seen by the details that some of these Studies hardly give 260 cubic feet.

Again, I must ask your Authority to recommend the School-Trustees to enquire into the food arrangements of the boys. This has been considered by some parents, who have written to me on this subject, as one of the causes of the boys procuring indigestible matter at the pastry-cooks. To this I have referred. The boys ought to have their breakfast before going out to their studies in the morning, and they certainly should not go supperless to their beds.

Other recommendations I have made when treating of the so-called *Sanatorium*, and I must now only add that these suggestions are made with the view of correcting a system which I feel convinced has operated badly on the boys' health, and if persisted in will render them less capable of resisting disease when exposed to it.

In the History of the Outbreak, I have detailed many facts on which I shall forbear to comment. I considered it was necessary that they should be given as I have noted them, as without them the history would have been incomplete, and the course of events unaccountable.

In conclusion, I beg to thank you, gentlemen, for the support you have given me throughout this tedious investigation, and I sincerely trust that whatever course you decide to adopt will be successful in securing one of the healthiest and finest sites in the country from preventable diseases.

I have the honour to remain,

GENTLEMEN,

Your obedient Servant,

ALFRED HAVILAND,

Medical Officer of Health to the Rural Sanitary Authority of Uppingham, Rutland; and to the combined Sanitary Authorities in the Counties of Northampton, Leicester, and Bucks.

Northampton, 6*th January*, 1876.

APPENDIX.

MORTALITY STATISTICS IN UPPINGHAM PARISH DURING THE TWENTY YEARS, 1856—1875.

NOTE.—In calculating the rate of mortality per 1,000 living in Uppingham Parish, two-thirds of the deaths in the Union Workhouse have been deducted, as probably belonging to other parts of the Union.

Years.	Estimated Population to the middle of each year.	Births.	Deaths from all Causes.	Deaths under 1 Year.	Deaths, 1 to 5 Years.	Deaths from 7 Zymotics.	Small Pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	Fever.	Diarrhœa.	Phthisis.	Deaths in Institutions.	Annual Rate per 1,000 Living.			Per-Centage of Deaths under 1 to Births Registered.	Years.
																From all Causes.	From 7 Zymotics	From Phthisis.		
1856	2,219		34	6	3	4	—	—	—	—	—	2	2	5	8	13·6	1·9	2·3		1856
1857	2,141		31	9	4	3	—	—	—	—	2	—	1	3	7	12·1	1·4	1·4		1857
1858	2,153		46	8	6	7	—	1	—	3	—	3	—	3	7	19·0	3·3	1·4		1858
1859	2,165		51	15	3	6	—	—	—	1	—	3	2	5	7	21·2	2·8	2·3		1859
1860	2,177		34	8	2	3	—	—	—	—	—	2	1	7	6	13·8	1·4	3·2		1860
1861	2,196		44	6	2	3	—	—	—	2	1	—	—	3	12	16·4	1·4	1·4		1861
1862	2,234		48	12	3	4	—	—	—	—	1	2	1	6	8	19·2	1·8	2·7		1862
1863	2,273		65	14	20	22	—	1	19	—	1	—	1	5	13	24·6	9·7	2·2		1863
1864	2,313		50	14	8	10	1	7	1	—	—	1	—	4	6	19 9	4·3	1·7		1864
1865	2,354		45	10	3	5	—	—	—	—	1	1	3	4	7	17·0	2·1	1·7		1865
1866	2,395		50	12	3	6	—	—	—	—	—	1	5	4	10	18·0	2·5	1·7		1866
1867	2,437		35	10	1	3	—	—	—	—	—	—	3	2	6	12·7	1·2	0·8		1867
1868	2,480		40	10	3	10	1	1	1	1	—	5	1	1	7	14·1	4·0	0·4		1868
1869	2,523		49	10	11	6	—	—	1	—	3	2	—	3	10	16·6	2·4	1·2		1869
1870	2,567		72	9	17	33	—	6	24	—	—	3	—	2	6	26·5	12·9	0 8		1870
1871	2,612	83	41	11	2	2	—	2	—	—	—	—	—	3	9	13·4	0·8	1·1	13·6	1871
1872	2,658	73	38	6	4	6	4	—	—	—	—	—	2	1	15	10·5	2·3	0·4	8·2	1872
1873	2,705	71	58	21	9	12	—	—	—	—	9	1	2	2	10	18·9	4·4	0·7	29·6	1873
1874	2,752	57	36	6	3	4	—	2	—	—	—	—	2	—	9	10·9	1·5	0·0	10.5	1874
1875	2,800																			1875

TABULAR STATEMENT

Of the results of the Analyses of twelve Well-Waters Analyzed in the Pathological Laboratory, on behalf of the Uppingham Sanitary Authority, May and June, 1875.

Number of water	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Ammonia by Na_2CO_3	0·00145	0·000277	0·00277	0·0133	None.	0·00138	0·02079	0·022176	0·00194	0·029106	0·11088	0·01386
Nitrous and nitric acid as nitric acid .	0·770	12·070	34·413	12·329	13·868	11·299	7·763	3·338	9·245	20·545	24·654	24·654
Chlorine	0·687	10·82	14·72	10·28	7·800	10·02	12·68	16·45	10·11	17·57	22·80	21·77
Sulphuric acid	2·200	10·711	16·633	9·706	10·580	16·818	15·957	15·833	15·658	18·944	19·305	20·727
Potassium as chloride . . .	0·6606	7·93	40·37	16·152	13·11	21·005	20·457	32·13	21·765	30·106	51·057	44·57
Sodium as chloride	1·6401	14·41	16·45	19·899	14·66	20·4518	21·384	23·31	21·509	30·600	35·706	26·98
Temporary hardness	14·00	14·70	33·00	14·00	20·80	24·00	29·00	33·50	18·20	12·00	32·00	20·50
Permanent hardness	3·00	33·00	31·00	11·00	15·20	24·00	16·00	9·50	23·00	36·00	28·00	41·00
Total hardness	17·00	47·70	64·00	25·00	36·00	48·00	45·00	43·00	41·20	48·00	60·00	61·50
Total solid residue	18·75	90·28	141·32	63·75	76·23	95·634	98·40	99·79	97·02	138·6	174·63	174·63
Loss by ignition	4·87	25·69	27·77	4·85	13·167	13·86	8·31	7·623	18·018	33·957	22·176	26·33

The numbers indicate grains per gallon.

To the Medical Officer of the Uppingham Sanitary Authority,
Alfred Haviland, Esq.

J. Z. W. THUDICHUM, M.D.
Pathological Laboratory, 3, Pembroke Road, Kensington,
June 19, 1875.

Analysis of water taken from Mr. Hodgkinson's Well, Uppingham, October 21st, 1875.

	Parts in 100,000.
Chlorine - -	2·50
Ammonia - -	·005
Albumenoid Ammonia -	·012
Nitrogen as Nitrates, &c. -	·20
Total Solid Residue -	45·00

Water bright and sparkling, although taken directly after very heavy rains.

M. F. ANDERSON, M.D.,
Coventry.

(*For Letter and Memorial, see p.* 13.)

RURAL SANITARY AUTHORITY, UPPINGHAM DISTRICT,

UPPINGHAM, 15*th January*, 1876.

DEAR SIR,

I laid before our Committee at their Meeting this morning your Letter of the 13th instant, stating that "in reply to the request contained in my previous Letter for the facts on which the Memorial was founded, you begged to say when an investigation takes place into Mr. HAVILAND'S conduct, evidence and witnesses will be ready and at the service of the Rural Sanitary Authority as soon as they are required for the purpose." I am directed to state in reply that the Committee do not consider it any answer to their request for a statement of such facts; and I have again to ask to be furnished with them.

I am also directed to ask to what you allude respecting an investigation before the Rural Sanitary Authority into Mr. HAVILAND'S conduct, when evidence and witnesses will be ready as required for such purpose; the Authority being entirely ignorant as to any such investigation.

Yours faithfully,

(Signed) WILLIAM H. BROWN,
Clerk.

Mr. JOHN HAWTHORN,
Uppingham.

RURAL SANITARY AUTHORITY, UPPINGHAM DISTRICT,

UPPINGHAM, 26*th January*, 1876.

DEAR SIR,

I am directed by the Committee to forward you Copy Minute made by them at their Meeting to-day. The Minute has reference to the Memorial signed by townsmen of Uppingham.

I also send a Copy to the Local Government Board.

I am, DEAR SIR,
Yours truly,

(Signed) WILLIAM H. BROWN,
Clerk.

A. HAVILAND, Esq.,
Medical Officer of Health,
Northampton.

[*Copy Minute, 26th January*, 1876.]

"The Committee beg to acknowledge the receipt of Mr. HAWTHORN'S Letter dated the 20th inst., which they do not consider a satisfactory reply to their Communication, they having asked for a statement of the facts on which the Memorial was grounded."

"In the opinion of this Committee Mr. HAVILAND, as a Medical Officer of Health, has merely done his duty in investigating the cause of the late Outbreak of Typhoid Fever in Uppingham; and, having perfect confidence in his integrity and ability, they are prepared to sustain him in his course of action."

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